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Report on the Heazlewood silver-lead and other
ore deposits.

(No. 108.)



1881.

TASMANIA.

HOUSE OF ASSEMBLY.

BEN LOMOND AND ST. PAUL'S RIVER:

REPORT ON MINES BY MR. THUREAU, F.G.S.

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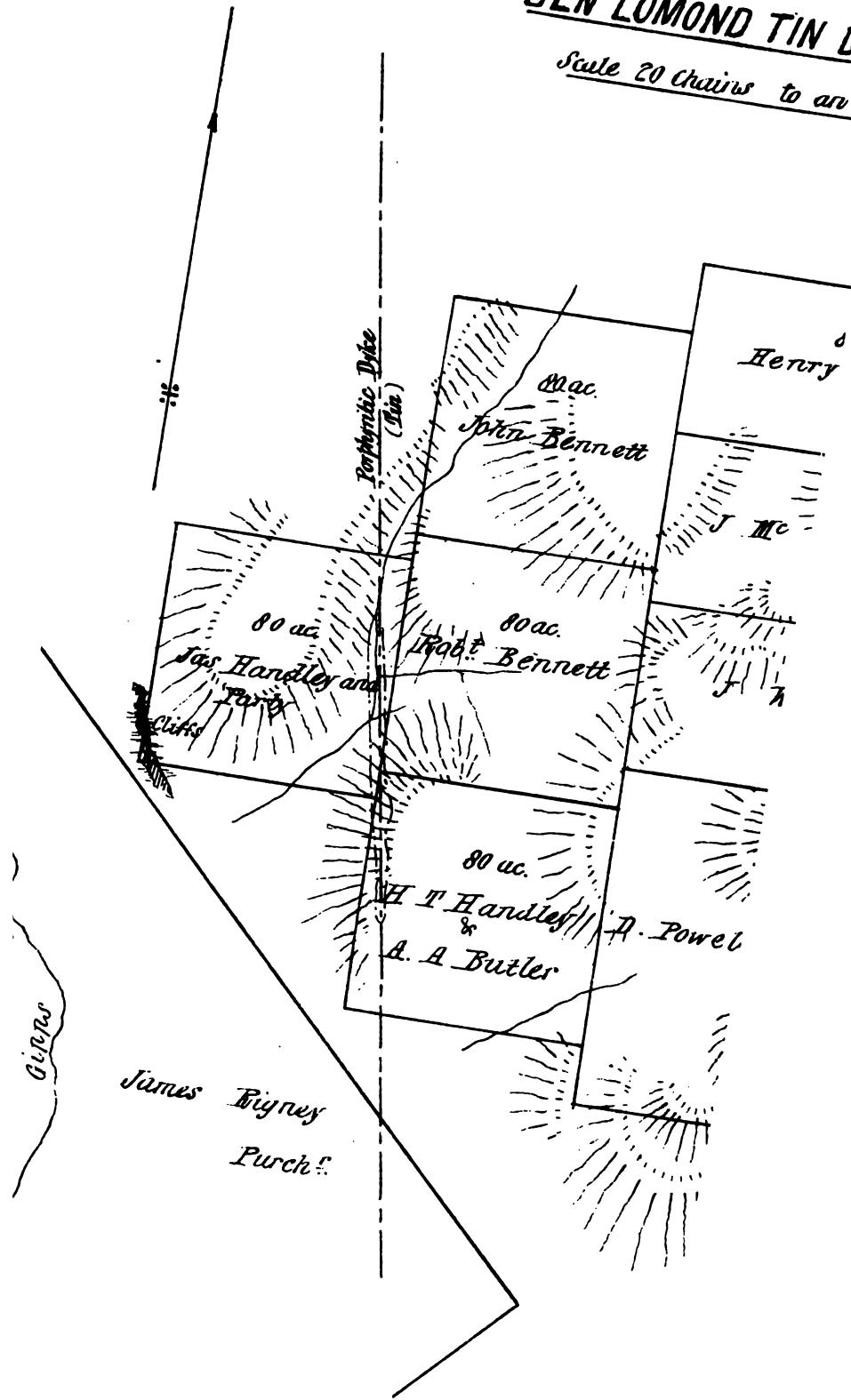
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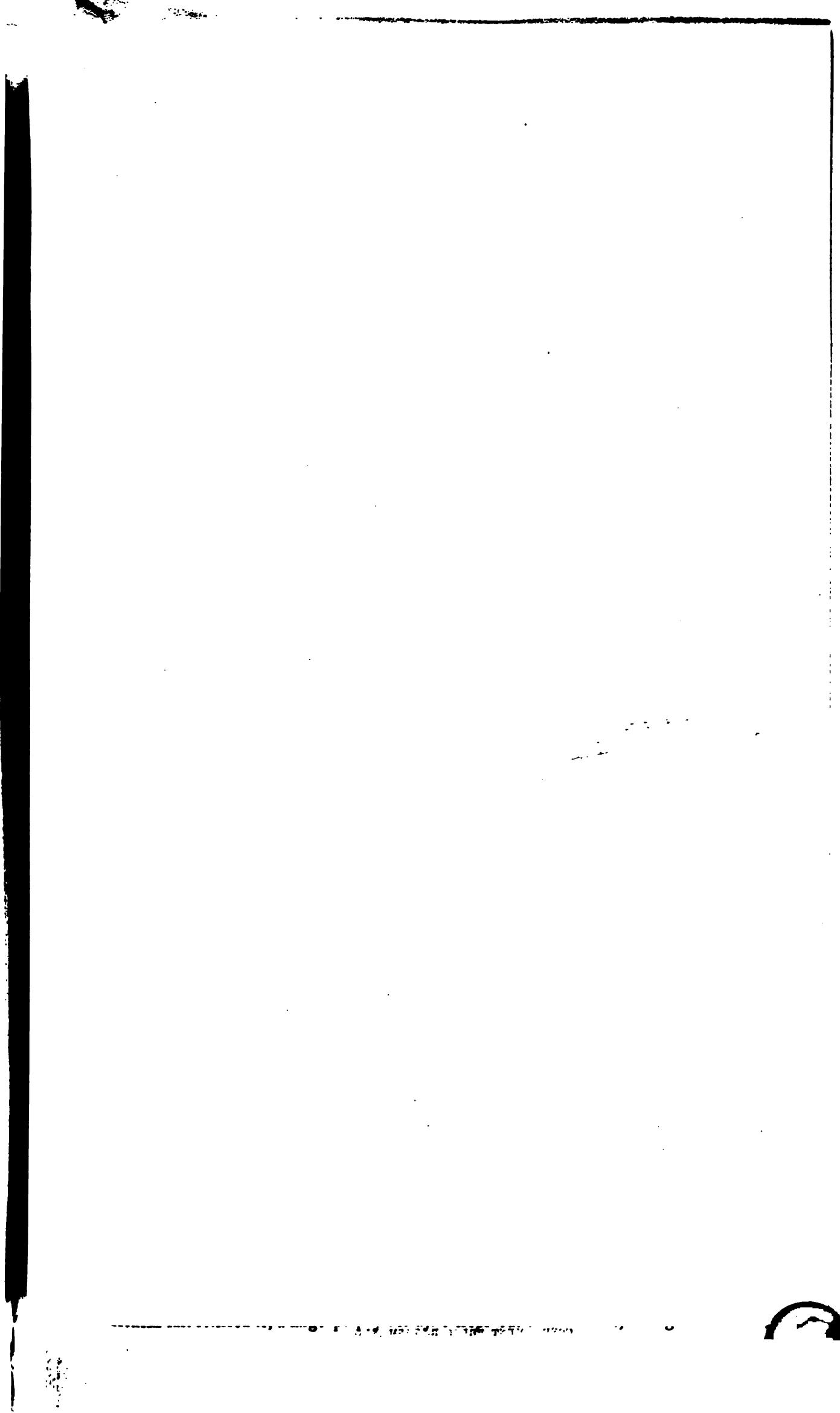
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REPORT ON THE BEN LOMOND TIN DEPOSITS.

Launceston, 9th September, 1881.

THE stanniferous deposits which I have lately examined of Mount Ben Lomond proper occur in several groups; and they are located to the south south west and to the south east of the highest peak of that mount. The geological features of this region, as observed on the track from Avoca, consist (after crossing the South Esk River) of alluvial sands and gravels resting on conglomerates covering the bedrock, principally sandstone and granite. (These conglomerates have been proved tin-bearing higher up the river.) The fine and coarse-grained sandstones crop out at the foot of the leading spur, and these form the lithological base of beds of rock overlying each other in succession; viz.—indurated sandstones, hard and dense metamorphic schists, porphyrites (dykes), and very coarse-grained granites, which dykes principally form the wall-rocks of the veins or impregnations of tin ores.

Gipps' Creek, which empties into the South Esk River some distance below the Township of Avoca, skirts the ground (at a considerable level below same) taken up by several proprietaries, west of Lot 213, which is situate about twelve miles from Avoca. Only one Company was at work there with a full complement of miners; and I may here remark that, where so much ground is held under lease from the Crown, and in a locality where a rich vein of tin ore has been discovered, and consequently the mining operations have passed beyond the stage of prospecting only, it is disappointing to find so very little work done since the ground was taken up. Without more rapid progress is made in mining operations by the adjoining leaseholders, it is impossible to test and to develop an extensive tin-bearing region such as now has been proved to exist on the slopes of Ben Lomond.

On Messrs. Powell and Evans' leases, of 80 acres each, prospecting and permanent mining has been carried on, and from time to time impregnations of crystalline tin ores have been found in the porphyritic wall rocks. At present the indications for permanency have become more satisfactory, on account of a vein carrying rich tin ore having been discovered, which presents a very promising appearance. The ore, i.e. the vein, is about one foot wide, highly metalliferous, and fully one-third of same is rich "cassiterite;" it presents a good laminated appearance, the matrix being of a quartziferous nature. Veins of fluor-spar, of a fine deep violet color, arsenical and iron pyrites, occur regularly; also spots and nests of felspar, radiating tourmaline, and chlorite.

In following this veinstone in its eastern underlay for some distance beneath the surface a "*slide*," or "*fault*" disordered the hitherto regular course of the lode, and after some considerable search the lode was found in the footwall side, but thrown for a distance of twenty feet to the west of the original course of the lode above the slide. Under or beneath the slide the vein is somewhat poorer and smaller, but in mining experience this is frequently the case, and by intersecting the vein at the 60-feet level from the main shaft, and by driving along same, the indications are favorable for this lode resuming its former productive character. The lode has a strike of N. 30° W., with an underlay of one foot in nearly three feet; the hanging-wall is well defined, but on the opposite side the ore gradually disseminates through the strata underlaying the ore, there being no defined footwall. The whole formation has a promising appearance, especially on account of the metalliferous character exhibited.

The only drawback to tin-mining hereabouts consists in the want of a good road (or tramway) of easy gradients to Avoca. The mines being situated at a very considerable altitude, the transport of minerals would otherwise be both tedious and costly to Avoca, which will become, in course of time, the centre of an extensive mining district.

Close to the south-western peg of Jas. Handley and party's 80-acre sections, and north-west of sections last referred to, a large porphyritic dyke crops out of the surface, having a strike of nearly

N. 9° W. This dyke occurs at the brow of a hill above Gipps' Creek, thereby offering facilities for a test at a lower level by means of a tunnel. The ore has been tested, I am informed, giving 12½ per cent. of ore per ton, or 26 per cent. metallic tin per ton. The mining from the surface with that per-cent-age, and the dressing, transport expenses, &c. would leave not much to the owners. A further test to or at deeper levels would be judicious, especially as this porphyritic dyke contains, besides tin, other metalliferous substances favourable to future developments at greater depths.

South east of and immediately adjoining Lot No. 682, and about 4 miles from the lode described as situate upon Messrs. Powell & Evans' leases, four sections have been taken up, forming a part of Lot No. 20. Two shallow alluvial gullies have there been worked, with moderate results; and some work has also been done in two places, close to the alluvial, upon tin-bearing impregnations, which deposits resemble each other considerably.

The tin ore occurs, as an impregnating medium, in a greenish, soft, feldspathic matrix, with indistinct crystals of quartz, bunches of radiating and very brittle tourmalines, also of a greenish hue. The veins are, so far as prospected to a depth not exceeding 13 feet, narrow, and the ore impregnations occur, for a width of from 4 to 9 inches, in small and large (complete) crystals throughout the matrix referred to, which is enclosed by granitoid and porphyritic rocks.

Several other alluvial deposits have been discovered; but as the mining operations thereon are, as yet, very limited in extent, further developments are requisite before such deserve examination with a view of specially reporting on same.

G. THUREAU, F.G.S.

THE ST. PAUL'S RIVER TIN DEPOSITS.

Launceston, 8th September, 1881.

THE Avoca Valley, which is watered by the South Esk and St. Paul's Rivers, is covered for a considerable length and depth by a flow of basalt, which, as far as seen, descends down that valley as far as Corners Station on the Main Line of Railway. Having already, in a former report, alluded to the great probability of a sub-basaltic gravel or ancient river-bed existing there, it should be mentioned that above the Township of Avoca some tin-bearing tributaries fall into the South Esk and probably into the St. Paul's River also; and that tin ore has been known to exist for a very considerable number of years past. At several points on that and the St. Paul's River also stream tin has been found, and worked on a limited scale.

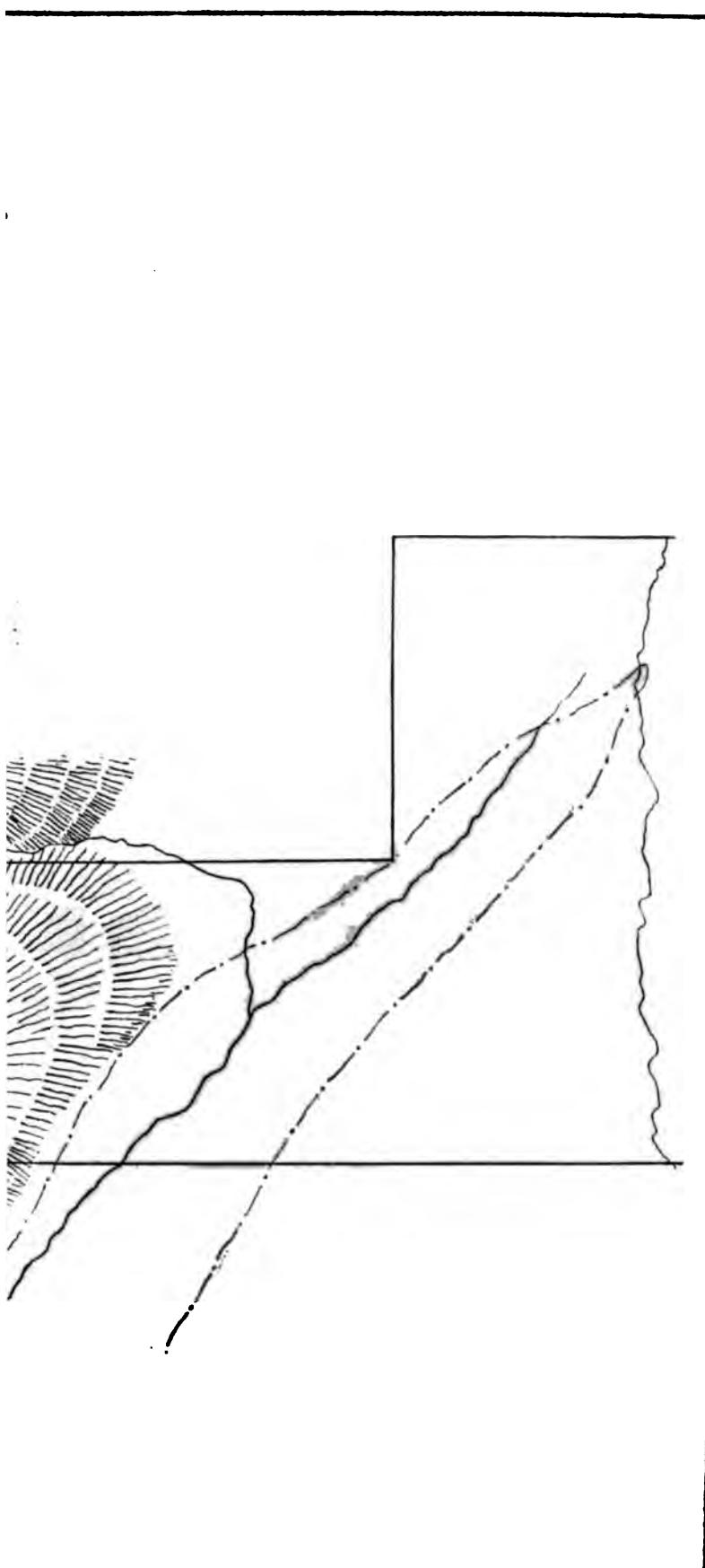
One of the sources higher up the valley, whence these tin deposits appear to have been derived from, is situated in the Parish of St. Andrew's, upon Lot 692, nearly due north-east from St. Paul's Dome. Unlike the granitic country rocks enclosing tin ores near Ben Lomond, the strata here consists of a variety of porphyrites, indistinctly stratified, in which however the denser and more feldspathic bands are impregnated with a good crystalline description of "cassiterite." At the surface the ore has been liberated after decomposition of the matrix; and, consequently, good prospects were obtained by washing the surface soil in the pan. The principal zone of these tin impregnations consists of a dyke (porphyritic) from 15 to 20 feet wide, a smaller dyke about 3 feet wide, and some others less distinct. These dykes are mostly of a quartzose character; and they exhibit, as component parts, the following minerals; viz.—Tourmalines, chlorites, and felspars. The underlay of the tin-bearing strata, parallel, though some distance apart, is synclinal, thus indicating a probable junction at some depth below the surface. The features observed in this vicinity are such as to deserve to be thoroughly prospected by means of a main shaft and cross drives at a greater depth than yet reached.

The facilities for transporting in future (should the locality be worked for tin as suggested) the ore to the Main Line of Railway, along a capital road, is an important advantage, if looked upon in comparison with mines located nearer to Avoca and the railway, inasmuch as they have much greater obstacles to overcome previous to shipping their ores.

G. THUREAU, F.G.S.

Dr. ANTHONY

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"the rock is manipulated on a large scale by means of suitable machinery, that will not only crush or grind extra large quantities of same, but likewise save the very fine gold, which forms so large a

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MR. THUREAU'S REPORT ON THE NORTH-WESTERN MINERAL DEPOSITS.

I. *Auriferous deposits* at the Minnow River, near Sheffield; quartz reefs (non-auriferous) at Castra road, near Ulverstone (Leven). [Plans 1, 2.]

II. *Argentiferous lead ores* at Mount Roland and Mount Claude, near Sheffield; also, at Penguin (with combinations).

III. *Cupriferous ores*, near Penguin, and near Barrington, on the River Forth.

IV. *Other minerals*—black hematite, near Penguin.

I. AURIFEROUS DEPOSITS AT THE MINNOW RIVER, NEAR SHEFFIELD.

These deposits are situated about eight miles in a direct line S.S.E. from Sheffield, but, by a newly cut track, twelve miles. The prevailing formations of rock for about three miles consist of basalts, furnishing the fertile soil in that locality. It appears farther on, however, that these volcanic rocks form the higher parts of the hills only, their bases being composed of grey sandstones, here and there protruded by the plutonic dykes of porphyries. The Minnow is a southern tributary of the Dasher River.

Gold has been found here in several places, but it appears that the sources are confined principally to the south side of the Minnow. Several tunnels have been driven under a very high hill there, owing to the circumstance of a number of specimens having been found on the surface, besides alluvial gold in the gravels along the base of this range. The principal country rocks are represented by grey and deep green slates, which dip to the north at angles from 75 to 80 degrees, and which are of an almost non-quartziferous character. For this slate, which has an almost due west by east strike, a tunnel has been driven by a company (the workings of which were first visited), to a length of 220 feet, and though one or two small veins of quartz were intersected therein, but slight traces of gold, of no prospective value, were obtained, as far as their present workings are concerned. A few chains to the east, but lower down the range, a shaft has been sunk by the Star of the West Company, also in slate (as first), to a total depth of 57 feet; at about 35 feet from the surface a change in the strata occurred, which has been maintained to the bottom mentioned. This new formation consists of a reddish rock, granular in parts, and it is intersected by quartz veins from $\frac{1}{2}$ in. to 14 inches thick; these veins dip north. The northern wall, as disclosed in the cross-cut driven from the bottom of the shaft in a southerly direction for a length of 20 feet, exhibits but very faint traces of alteration at the junction of the two rocks. After close examination I found this rock to be a porphyry, in which small crystals of felspar and hornblende were sparsely distributed, with some mica. It is of considerable importance for the future prospects of the locality to draw attention to the fact that this gold occurs both in the quartz leaders referred to and also in the porphyritic matrix, which latter, owing to its decomposed and friable state, can be worked at a very economic rate, or otherwise the ascertained average yield of only 3 dwts. of gold per ton would be the reverse of payable. As stated before, the southern wall of this "dyke" of porphyry had already been intersected, but the opposite or northern wall has not in these two mines been traced, though the discovery of specimens at the surface seem to mark its probable course, and offer inducements for its being traced to its permanent position.

Altogether this auriferous porphyritic dyke cannot be under 200 feet in width from wall to wall, and should it retain its present decomposed character to greater depths, even the low per-centge of gold, which is somewhat alloyed with silver, as mentioned above, would prove moderately payable, if the rock is manipulated on a large scale by means of suitable machinery that will not only crush or grind extra large quantities of same, but likewise save the very fine gold, which forms so large a

these iron pyrites occur, either in their natural state or decomposed, as evidenced by the ochreous water exuding in many places from this rock. Quartzose veins, exhibiting carbonates of iron, calc spar, and cubical crystallised galena, have been detected in small detached bunches against and in connection with a hanging-wall, which is accompanied by a divisional band of clay selvage or "dig."

It may be observed that these separate and so far isolated efforts for developing these scattered mineral deposits are ventures deserving of every commendation; but, to judge from their nature, including the want of well-defined formations in the shape of large veins and irregular lodes capable of yielding large quantities of argentiferous lead ores, it would be perhaps more judicious on the part of the present prospecting companies to combine in the systematic search and exploitation now initiated by each.

And in this connection it would likewise deserve the attention of all concerned in the testing of these promising metalliferous deposits to confine in future their operations to the tracing of same "down" the slopes of the mountains, instead of tunnelling upon same near their outcrops under the conglomerates, where but a limited extent of "backs" could be worked overhead, and at a great deal more expense than if nearer the base of these ranges. As I observed several ferruginous outcrops ("gossan"), so often indicating the existence of these and kindred deposits, attention to same would probably result in new discoveries.

At the head of the Dasher River, or a tributary of that watercourse, the track leads due south over the main divide of Mount Claude, which there is located 735 feet above Claude Creek (south of the divide), and on the banks of that creek, is where the principal (county of Devon) mining operations are being carried on, owing to the discovery of rich "gallenites" in ore bodies more profusely distributed in a belt of rocks peculiar to same, and in more satisfactory quantities than elsewhere hitherto examined and reported on.

The Mount Claude Silver-Lead Co. are confining the sphere of operations upon the localities where the original prospectors first discovered the absolute existence of silver-lead ores. Since then the other discoveries have been made, but altogether the operations of the latter are on a limited scale in comparison with those in progress at this mine.

It is in the precipitous banks of the Claude Creek, a tributary of the River Forth, that these rich ores were much more strongly developed than anywhere else; and the subsequent mining operations have disclosed satisfactory evidence as to the continuance of these deposits over a greater scope of ground than was at first anticipated. Beside the denser, and therefore richer, varieties of "gallenites," the following minerals occur in combination with the same, viz.—Copper pyrites (chalcopyrites), quartz, and carbonates of iron (siderites). The rocks, especially those in which these deposits occur, include metamorphic schists (chloritic) and porphyritic beds, exhibiting garnets, and their strike is from north east to south west, thus nearly identical with the direction observed of the enclosed ore bodies, which, generally speaking, run parallel with and within the bedding-planes of these country rocks; thin beds of slaty structure intervene occasionally with the larger bedded and coarser schists. These rocks constitute the local "ore carriers," and their width, within which ores have been found (at right angles with their strike), cannot be less than 400 feet. It should be understood, however, that in that space the deposits occupy but a very limited part, inasmuch as the ore veins are irregularly distributed throughout, and that they (the veins) vary from half an inch to not more than 7 inches in thickness. In the whole formation divisional and bedding joints occur, the former often distinguished by a clay selvage here and there, but regular and well defined walls are wanting. The only perceptible difference I observed was that in the lower workings on the creek the strata became more and more quartzose than at any other part of this formation. The workings just below the second waterfall on this creek exhibit an anticinal section. Fine grained porphyritic schists, alternating with bands of more slaty schists, occur here; and the latter having been removed by the action of water, formed caverns in the rocks arching overhead. A main level is following at this place one of the divisional joints already alluded to, which is indicated by a clay selvage, but as the beds have not suffered any dislocation in their position, such cannot be taken for a wall. [Plans 6, 7.]

The other workings consist of shallow shafts, cuttings, and a tunnel near the highest point of the formation, or about 250 feet above the creek. The banks on both sides of the creek have also been subjected to a great deal of mining operations, all of which tend more or less to exhibit the presence of argentiferous lead ores.

The ores comprise "gallenite" (lead sulphide) principally; and as they occur, as elsewhere, in crystalline metamorphic rocks, they are distinguished by the presence of, or rather admixture with, the sulphide of silver. The larger veins of ore show a streaky and rich appearance from the coarser granular variety, with a brilliant fracture, to the very fine-grained, steel-like, or compact, with scarcely any lustre. Owing to the great solidity and hardness of these ores, only traces of anglesite (lead sulphate), or the white lead ore (cerussite), could be found. The mineralogical character of these ores is such as to class them with those rich in silver. Assays have been made, I believe, to support that view.

The workings were laid out principally, it would appear, for the purpose of ascertaining the limits of these deposits; and it is intended to test same likewise by means of a low level adit, to be driven across that metalliferous belt, so as to facilitate the delivery of the ores mined at the proposed reduction works to be built in the near future.

Considering the peculiar character of the ores, and their mode of occurrence in the shape of irregular veins, bundles, or pockets (stockwork), I submit that the ordinary methods for mining same economically may not be found to answer with "backs" over 200ft. vertical above the creek. The driving of levels, sinking of winzes, etc., etc., upon such irregular runs of ore would become a very expensive feature in future. Open face cuttings following the more extensive and regular veins, reserving the less richer ores for special dressing and cleaning, would, in my opinion, answer the purpose better, because of the less trouble in tracing the veins, etc., and of the greater facilities for securing the ground without much timber.

These compact ores require but little dressing to fit them for the market in bulk; and it may be observed that it has of late years been found in practice stamping such very brittle ores embedded in much harder matrices has been discarded, owing to the thereby greater production of metalliferous slimes that are passing away with the turbid water. Grinding by means of newly-designed machinery, and dressing the ores so as to intercept the clean portions of same at various successive periods during the process without the production of too fine a grain, has been found to be more economical and to achieve increasing profitable results.

As to the permanency of the ores enclosed in this extensive metalliferous belt, it may be stated that equally as rich ores cropped out at the surface 130 feet above the lowest workings on the creek as those in that lowermost cutting into the bank both westerly and easterly, the latter including the "Round Mountain."

The local water supply would be sufficient for all purposes if a weir or dam were constructed across the Claude Creek above the upper waterfall; ample water pressure could then be obtained for working a powerful turbine, the greater motive power of which could be utilised for driving the ore-dressing machinery and the other appliances requisite to work the mines. Owing to the absence of coal near the mines, and the necessary ingredients for "fluxes," the reduction of the ores by means of calcining, smelting the rough lead ores, and the cupellation of the regulus, and the refining silver resulting, need be postponed until these materials can be got nearer the mines. It will therefore be found more advantageous to dispose of the cleaned lead ores as per assay, because otherwise the construction and maintenance of expensive furnaces and other works, together with the employment of a skilled staff of workmen, would become a necessity, thus adding considerably to the preliminary expenses of a description of mining new to Tasmania, and not much understood; under these circumstances, I felt justified in drawing the attention of those interested in these valuable deposits to their possibly future obligations. Irrespective of all these matters, and ignoring for the present the assays made of the ores, it should be remembered that the experience of other countries has been that mines producing large quantities of low grade ores are more reliable than those yielding smaller quantities of high grade, the former proving the best investment. In Europe, lead ore, which contains from 6oz. to 9oz. of silver to the ton of lead, is worked for silver, the lead being a by-product, so that in the present instance a judicious blending of the richer with the poorer class of ores would have an encouraging result.

Should any coal measures exist at no great distance from the mines or of the coast, and should good fireclay, iron ore, and lime be found with same, then the reduction works could be built in the vicinity of that combustible and the other valuable mineral adjuncts.

The Tasmania Silver and Lead Mining Company are prospecting upon Messrs. Manley and Young's section, situate about half a mile nearer the Fork River. The country rocks differ from those in the Mount Claude Co.'s leases, thereby indicating, besides other evidence, a more northerly position of ground held by this proprietary, than if the metalliferous belt had been traced from that company's workings. Dark blue and hard slates prevail, showing imperfect petrifications, probably of the upper silurian period or age. These alternate with bands of sandstone, all of which dip to the west. A tunnel (or approach to one) has been commenced 150 feet beneath the summit of the range, which is almost vertical at this west side of Claude Creek, and rises to nearly 500 feet above the same. At the entrance a dyke of schistose greenstone occurs, at the back of which the lead formation is faintly indicated in its western underlay by the presence of strings of veiny mineral matter 2 feet 6 inches thick. These veins are narrow, and they contain very bright crystalline iron pyrites, with specks of cubical galena not rich in silver, in contiguity to a band of clay selvage. Owing to the limited extent of the workings, no proper and practical opinion as to the permanency or possible improvement of these indications could be arrived at.

Argentiferous Lead Ores (with combinations) at Penguin.

These deposits and the minerals they are associated with have been known to exist for some years past as occurring along the seashore, where they are exposed below high-water mark. The country rocks belong to the fragmentary section, composed of fine and coarse conglomerates, in

which red and yellow-coloured jaspers and black hornstone appear as essential ingredients. These rocks have been protruded by basaltic dykes near the Neptune mine, in the vicinity of which a friction breccia has been formed, which exhibits, besides the ordinary conglomeratic fragments, also those of slates, schists, and quartz. The coast ranges farther inland are in this locality capped by basaltic overflows, thus producing good arable soils on the slopes.

The workings at these mines, except the main shaft of the Neptune S. L. Mining Co., were all filled with water, so that my examinations were necessarily confined to what could be seen of the mineral deposits on the surface at low water.

The Neptune Silver-Lead Mining Co., profiting by their past experiences of their western neighbour, the Penguin Silver-Lead Mining Co., are sinking a main shaft above and beyond the reach of high water; this shaft is one of the best I have seen in this colony for strength and capacity. It measures inside the frame sets 8ft. by 5ft. 11in. in the clear. The sets are 3ft. apart, and the square timber used for same measure 8in. and 10in. in diameter respectively.

By means of this fine shaft the mineral deposits may be followed and worked with the aid of powerful pumping and winding machinery on a very extensive scale and to very considerable depths beneath its present bottom at 30ft. from the surface. A lode, having a strike of N. 30° W., with a westerly underlay, has been found 6ft. wide at the surface, and 3ft. in the bottom of shallow workings. In its northern course it has been interrupted by a dyke of basalt ("andesite"), which is enclosed on both of its walls by a friction breccia. It is a remarkable fact that the original lead ores become sensibly more argentiferous after being faulted by this dyke in the north. The underlay of this formation averages 1ft. in 6ft. On the foot-wall a very dense vein of lead ore, 3in. thick occurs; and another similar vein at the opposite wall; the remaining portions of the lode, 3ft. wide altogether, being impregnated by lead ores, with calcites and heavy spars. These lead ores, dressed by hand up to 60 per cent. of lead per ton, are besides assaying to 25oz. of silver per ton of lead, which would leave a very fair margin of profit. There are strong indications of other deposits of a similar character, which, however, require prospecting at lower levels in order to ascertain what value they may possess, and for these tests the main shaft is singularly well situated.

The Penguin Silver-Lead mine was the first that was discovered on the North-Western Coast of Tasmania, and some considerable amount of work appears to have been done periodically. These workings were all flooded, as this company's main shaft is subject to immersion at high water.

The country rocks are similar to those already described; in addition, a dyke of hornblendic porphyry, interspersed by large patches of iron pyrites, traverses the ground, causing probably the transmutation of the argillaceous deposits into hornstone, which occurs here in a massive bed, made the more prominent on account of its containing native copper in scaly and hackly forms. At low ebb this coast presents a very peculiar appearance; ferruginous veins traverse the rocks there exposed to view as occurring in several places and at various angles to each other; and in the western portions, which appear to be more metalliferous than the remainder, huge blocks of hornstone and jasper crop out, containing large numbers of pyrites stained green, thus indicating the presence of copper along that channel of country.

The eastern lode in this company's ground has a strike of S. 26° W., with an underlay of about 80° W., at a distance of 124ft. east of the main shaft; the vein matter is impregnated by silver-lead ores; blue and green carbonates of copper stain this formation and the adjacent strata.

In their main (whim) shaft, which is 70 feet deep, a vertical leader 14 inches thick was followed to the 60-feet level, from which depth some rich ores were raised. There is, however, a great deal of difference in the ores in these workings and those obtained by the adjacent Neptune Co., because the former are mixed with copper pyrites; they are also very much richer in silver, and they contain less lead. The samples I was able to collect contained mostly "fahlores," or argentiferous grey copper ore, embedded in quartz, calcite, and heavy spar, and all these were accompanied by a considerable percentage of iron pyrites. The eastern lode, and the vertical leader in the shaft, run nearly parallel with each other; another leader was intersected 30 feet west of the shaft, at the 60 feet level, which gave rich ores, and in a winze sunk 30 feet deeper on its underlay a considerable improvement was observed. Still farther west another surface formation was discovered beneath a "gossan," carrying galenites and fahlores. This vein is about 2 feet wide, and occurs along one good wall. It produced, besides the other ores, a little native silver in contiguity to the hornblende porphyritic dyke already referred to as containing native copper, with associated ores, and some 500 yards west of the main shaft. Altogether, the mode of occurrence of these various metalliferous deposits at Penguin proved rich in valuable metals from a mineralogical point of view, and more so from assays; these constitute the basis of very satisfactory evidence in support of more extensive operations being undertaken at greater depths, either by means of ordinary mining operations, *i.e.*, shafts, cross-cuts, and levels, or, as a preliminary, to employ the mining diamond-drill, which would perforate and prove the value of these and deeper located deposits in a very short time, besides affording, inexpensively, substantial proofs of their permanency in depth or otherwise.

III. CUPRIFEROUS ORES NEAR PENGUIN.

The Whatcombe Prospecting Co. have been engaged in tracing the continuation of the hornstones inland, which, it will be remembered, were described as being charged with copper and its ores, and for this purpose a number of surface cuttings were made along the supposed course of same as observed by the compass. Indications were followed carefully as they presented themselves, and rough assays made from time to time, one of which gave 5 ounces of silver per ton and 3 per cent. of copper, thus demonstrating that the "gangue" still remained metalliferous, though it was filled between the walls, which were 6 feet apart, with fragments of rock and vein stuff. Subsequently, a prospecting shaft (5 feet x 4 feet) was sunk to a depth of 26 feet, (on the slope of the hill), in which the track of the lode was again cut in the western end of the shaft; here it was enclosed in metamorphic schists interspersed with iron pyrites. The lode is composed of pieces of wall rock, bluish hornstone, and the vein matter shows traces of silver ore, copper, and iron pyrites, and stains from carbonates of copper. As these features repeated themselves near to and for some distance along the surface, it would be judicious to test the deeper ground in preference to any more surface exploitation in future.

One and a half miles south of the Penguin township the Devon Consols Copper Mining Co.'s workings are located, 350 feet above sea level, on a western tributary of the Myrtle Creek, which flows into the River Leven. The deposit which is being tested observes a strike of South 60 degrees West, and is of quite a different character than any other I have observed in the vicinity. Several surface cuttings and two prospecting shafts sunk on the vein three chains apart expose the features of a well defined and good looking metalliferous deposit. This vein was discovered in the gully, and on being found to continue on both sides of that water-course it was noticed that the "cap" was formed of an ochreous, porous, and brittle rock, deep brown in colour. Curiously enough, native copper in long hair-like hexagonal prisms is diffused throughout this substance, presenting a very interesting feature. As the vein occurs in a dense green feldspathic porphyry, with large crystals of felspar, which, however, nearer the vein becomes soft or "kindly" and steatitic, the development of the deposit in such country, and under such favourable conditions, augurs well for the future at greater depths, as similar to other deposits. [Plan 8.]

Beneath the "cap" this vein, 2 feet in width, is parted into two ore-carrying bodies, a "horse" of greenish soft rock, strongly resembling the soft decomposed "lava dykes" of the Bendigo quartz reefs, 1 foot wide, occupying the centre. At a depth of 18 feet the vein has become 5 feet in width, having a slight western underlay, and every indication of forming eventually a strong deposit in depth. The intrusive mass or "horse" disappeared at this depth, and in place the vein matter becomes highly cupriferous in the centre of the formation. The ores consist of grey and black (soft) oxides of copper, mixed with particles of native copper; the former gave, as per Mr. C. Newbery's assay, 32 per cent. of copper, or, the ore taken from the vein as it comes, 19 per cent. to the ton, which is certainly a very satisfactory return; the ground can easily be worked in the initiatory stages of operation by means of adits; a good and sufficient supply of water for mining purposes can be secured at reasonable expense, and useful timber is abundant on the ground.

Cupriferous Deposits near Barrington, on the River Forth. [Plan 9.]

These are located about eight miles from the township of Hamilton-on-Forth, above the junction of the Wilmot with the Forth River, or nearly two miles south of the lately gazetted township Alma at that junction.

The country rocks in which these deposits, or, as they would be better described, indications, are found to occur, belong to the metamorphic series, consisting of schists, slaty in fracture, and coarser kinds, yet retaining evidence of their sedimentary origin; also, of porphyrites of a feldspathic character. The "indications," for they are such and no more at present, comprise the following; viz.:—Certain portions of the schists in the tunnel exhibit occasionally native copper in the joints; heavy spar (barite) occurs in conjunction with copper pyrites (chalcopyrites) in small veins, enclosed also by these schists, and some of the beds of rock are slightly stained by the green carbonate of copper.

The workings made by this prospecting proprietary include the usual description of cuttings from the surface on the course of the deposits, and a main tunnel driven in a north-westerly direction to a length of 281 feet; two cross-cuts extend from this tunnel to the west for a length of 33 feet and 32 feet respectively. In these workings the character of the ground required very careful timbering, and these and other requirements for carrying on mining operations speedily and economically have been completed in a good workmanlike manner. Throughout the whole length of this tunnel, and of the greater portion of the two cross-cuts, black, hard, short-pointed schists prevail, in which the veins of barite occur, which carry a small percentage of copper pyrites. Similar veins are likewise found in similar rock about six chains above the mouth of the tunnel. At both ends of the cross-cuts a new formation has been discovered; grey, hard, metamorphic sandstones, in which small rounded pebbles may yet be distinguished with some difficulty, and other features not necessarily important to dwell upon, demonstrate that these rocks belonged, previous to their metamor-

phism through plutonic action by the porphyries in their vicinity, to the "transition" (Laurentian?) series. In the divisional joints between those schists and those transition beds, a greasy soft clay selvage marks these formations as distinctly different.

Taking into consideration all the facts and features connected with the cupriferous deposits so indistinctly indicated at the surface and underground, and comparing same with mines producing ores in quantity, attention should be drawn to the fact that regular walls are here altogether absent, and that the only reassuring feature on the ground consists in the recurrence of outcrops of "gossan" in quartzose veins also containing barites (heavy spars) and carbonates of iron (siderite). These minerals are frequently found in connection with metalliferous deposits, and, therefore, I would suggest that the tunnel be extended a farther distance of 200ft., more or less, in the direction of and under the largest surface outcrop of ochreous gossan; it would be also judicious to cross-cut farther west from the tunnel, in order to test the contact of the porphyries there with those of the metamorphic schists.

IV. OTHER MINERALS.

Black Hematite, or "Limonite," I found on the beach at Penguin, and to judge from the outcrop, a considerable quantity of this ore could be obtained at little expense. The fibrous structure and botryoidal form of the surfaces were defined in the ordinary way of occurrence.

Near the Devon Consols Copper Mine a very large outcrop of a denser, and probably equally as valuable, iron ore obtains. This deposit would be useful if good coal, fireclay, and lime were found in the vicinity.

G. THUREAU, F.G.S.

GENERAL AND SUPPLEMENTARY REPORT.

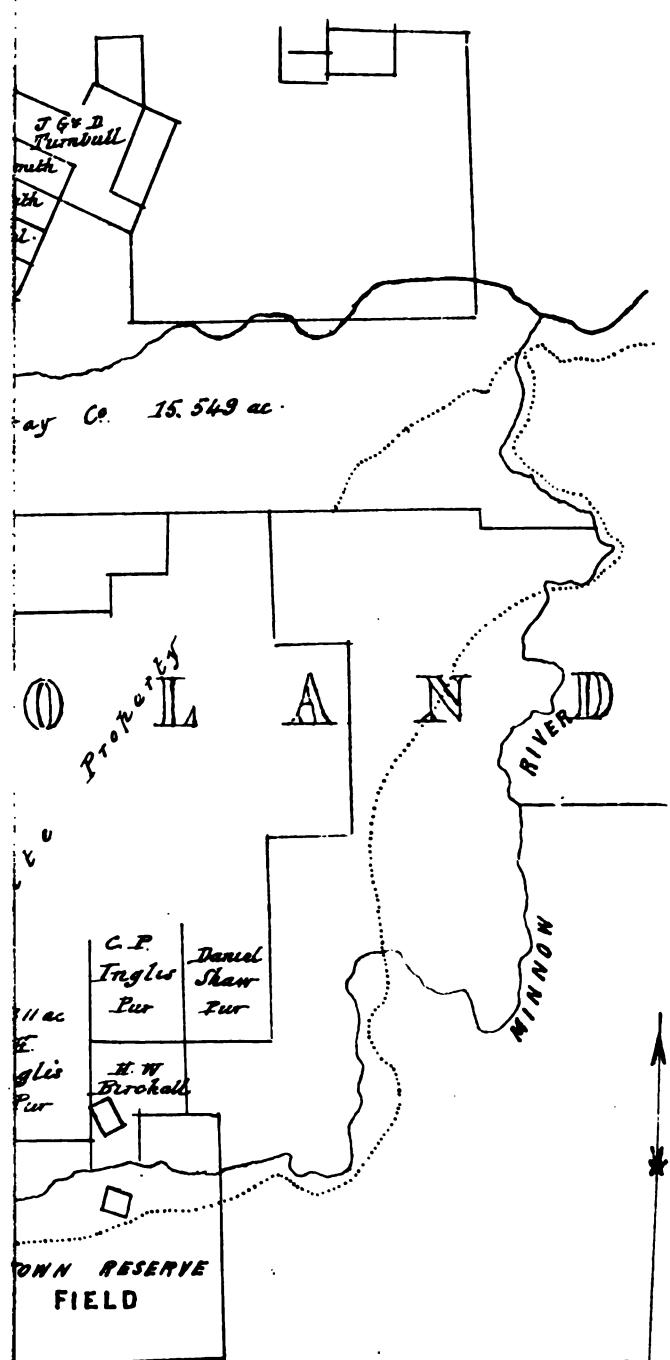
From the above reports, and the charts, sections, and sketches accompanying same, it will be perceived that this tour of inspection to the north-western portion of the colony has not only been an interesting one, but that it has likewise furnished much information which can be turned to valuable account.

Hitherto my instructions from the Hon. Minister of Lands and Works have confined my labours to examinations of stanniferous, auriferous, and carbonaceous deposits; to these, however, must now be added the argentiferous lead deposits at Mount Roland and Mount Clande, and Penguin, and the cupriferous deposits also at Penguin, as of immediate commercial value; leaving the Castra Road reefs, and the indications for copper near Barrington, to be tested more thoroughly before they can be included in the above list as really valuable.

What with the very satisfactory developments of the West Coast gold and tin mines, and other mining districts reported on nearer home, the pursuit of economical and systematic mining in Tasmania deserves, doubtless, the unabated attention of all classes, as forming the lever by means of which, if honestly and judiciously handled, the whole Island would be materially benefited, because if the mineral resources now being developed continue to give good results, both capital and population will be attracted to these shores. And, in conclusion of this report, I may also state that during my peregrinations many favourable indications were observed which circumstances over which I had no control prevented me from thoroughly examining; and, in my opinion, there are yet many more places deserving the attention of skilled prospectors, where, by cutting tracks, valuable discoveries may be made.

G. THUREAU, F.G.S.

Hobart, 30th December, 1881.



Scale: One inch to a mile.

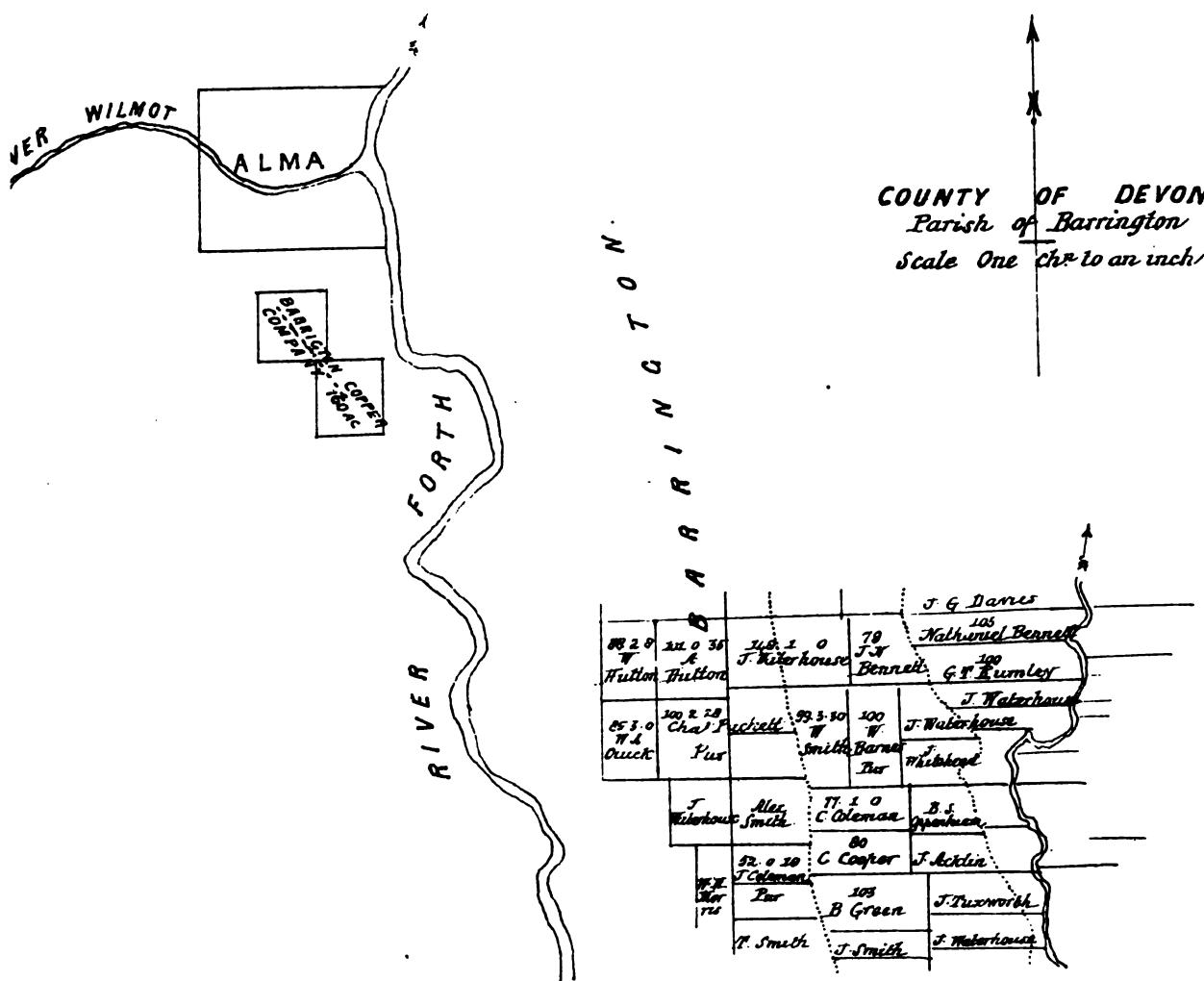
MAIN

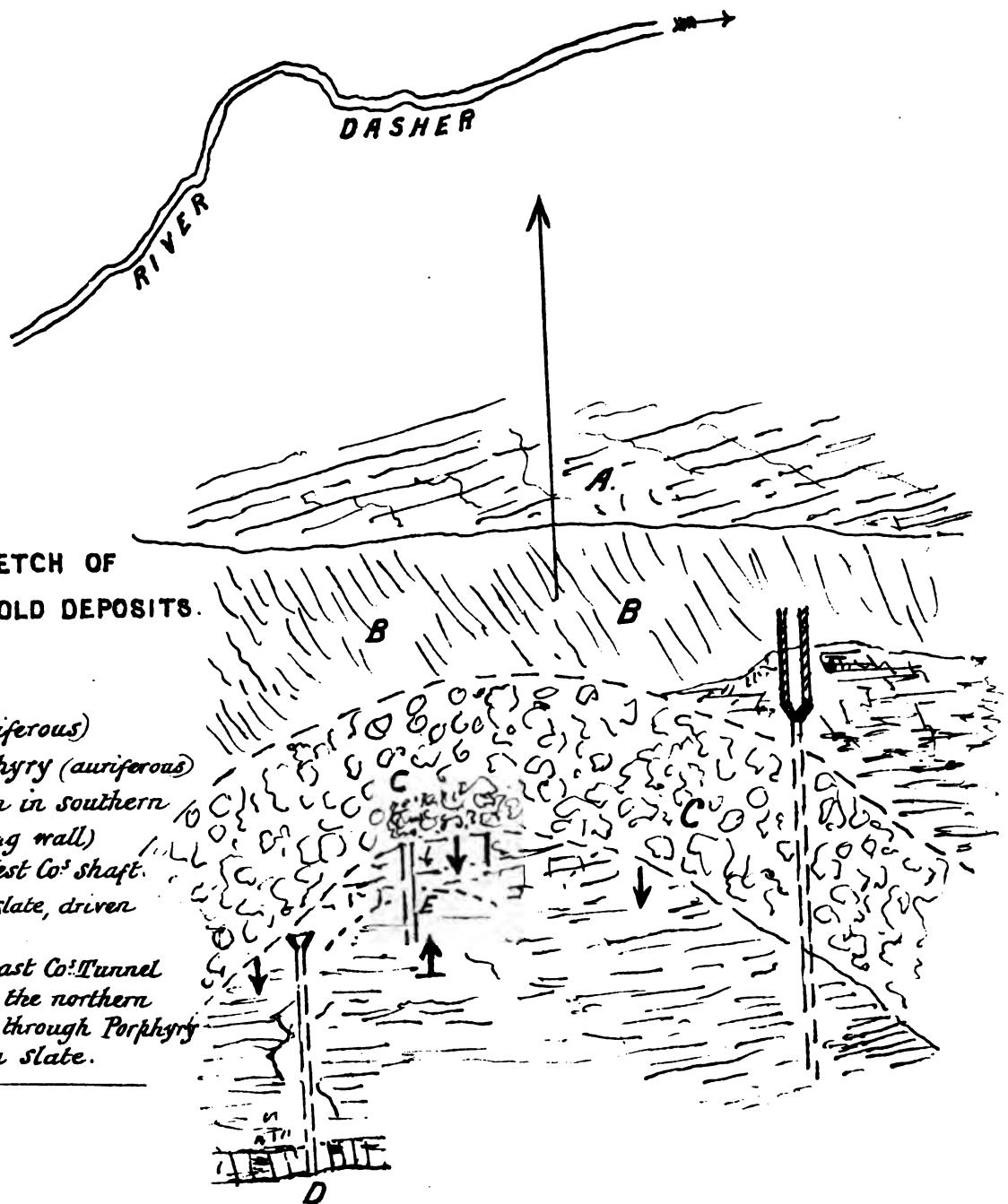
PLAN N°2.

COUNTY OF DEVON
Parish of Barrington
Scale One cm to an inch

Scale One Chr to an inch.

scale one in to an inch







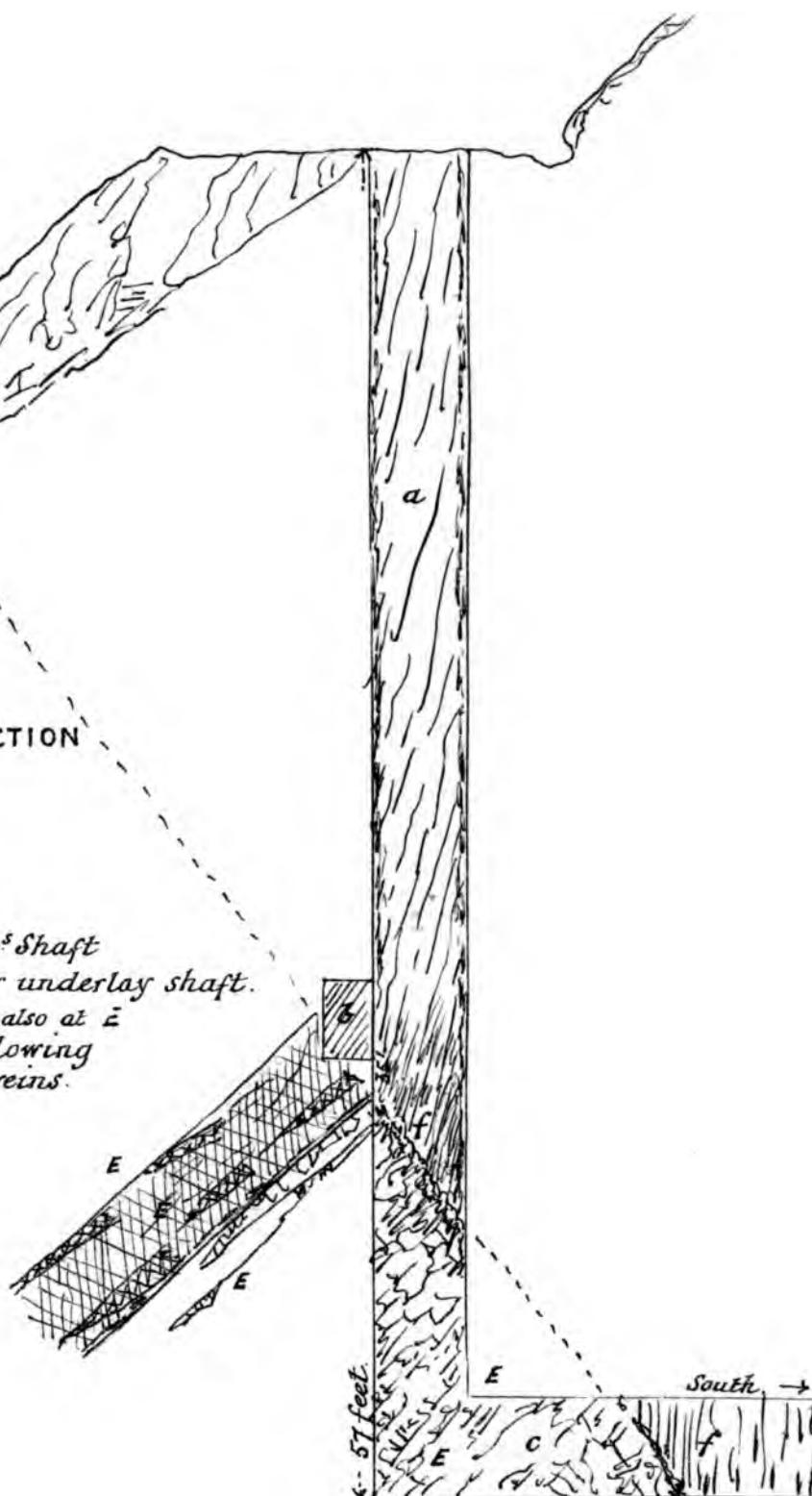
PLAN N°4
GEOLOGICAL CROSS SECTION
AT THE MINNOW

GOLD DEPOSITS.

- a. Star of the West Co^s Shaft
- b. Upper platform for underlay shaft.
- c. Porphyritic Dyke also at e
- d. Underlay shaft following auriferous Quartz veins.
- f. Slates

←-- North.

→-- South.



v N°5.



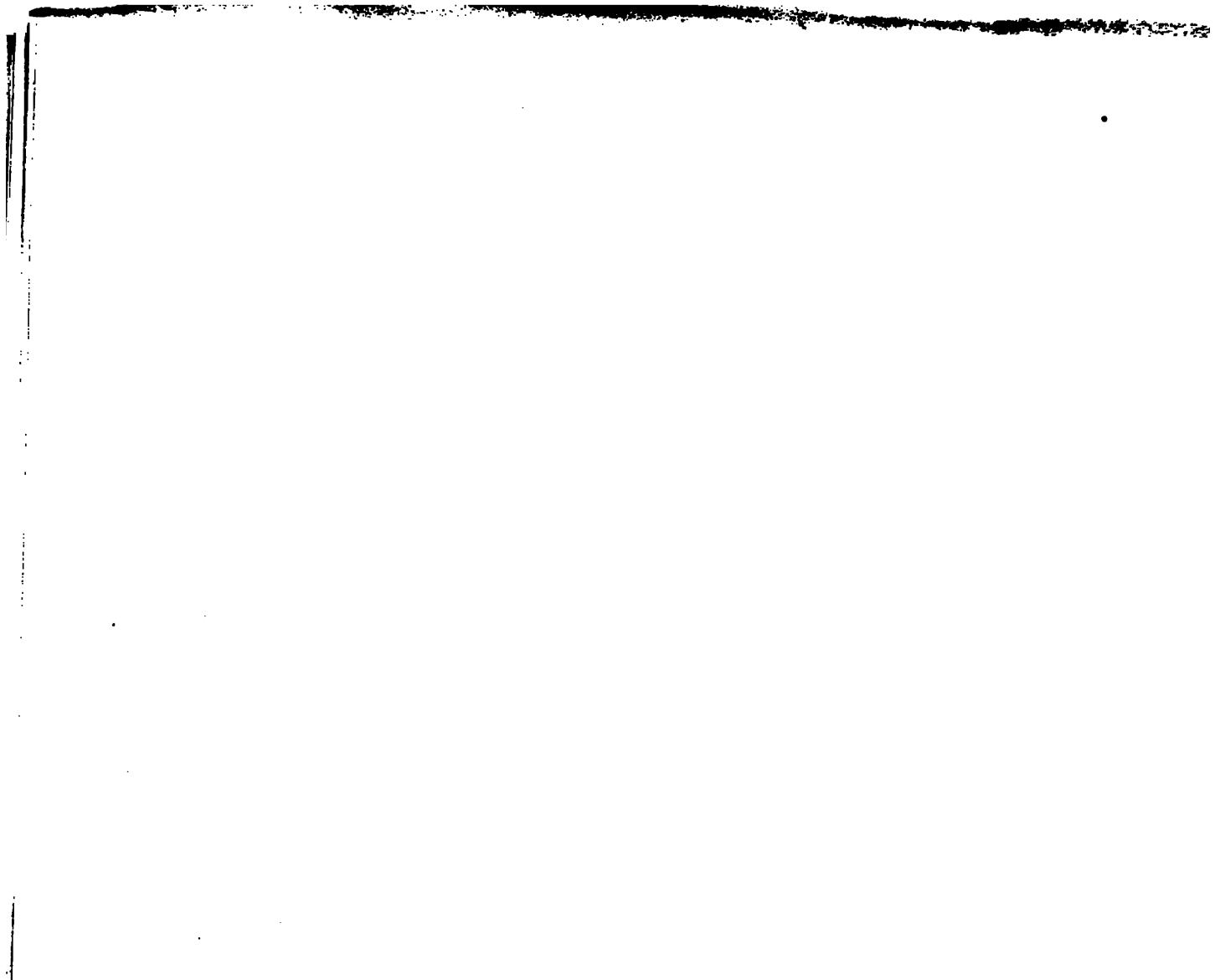
MT CLAUDE SILVER LEAD CO

(WORKINGS).

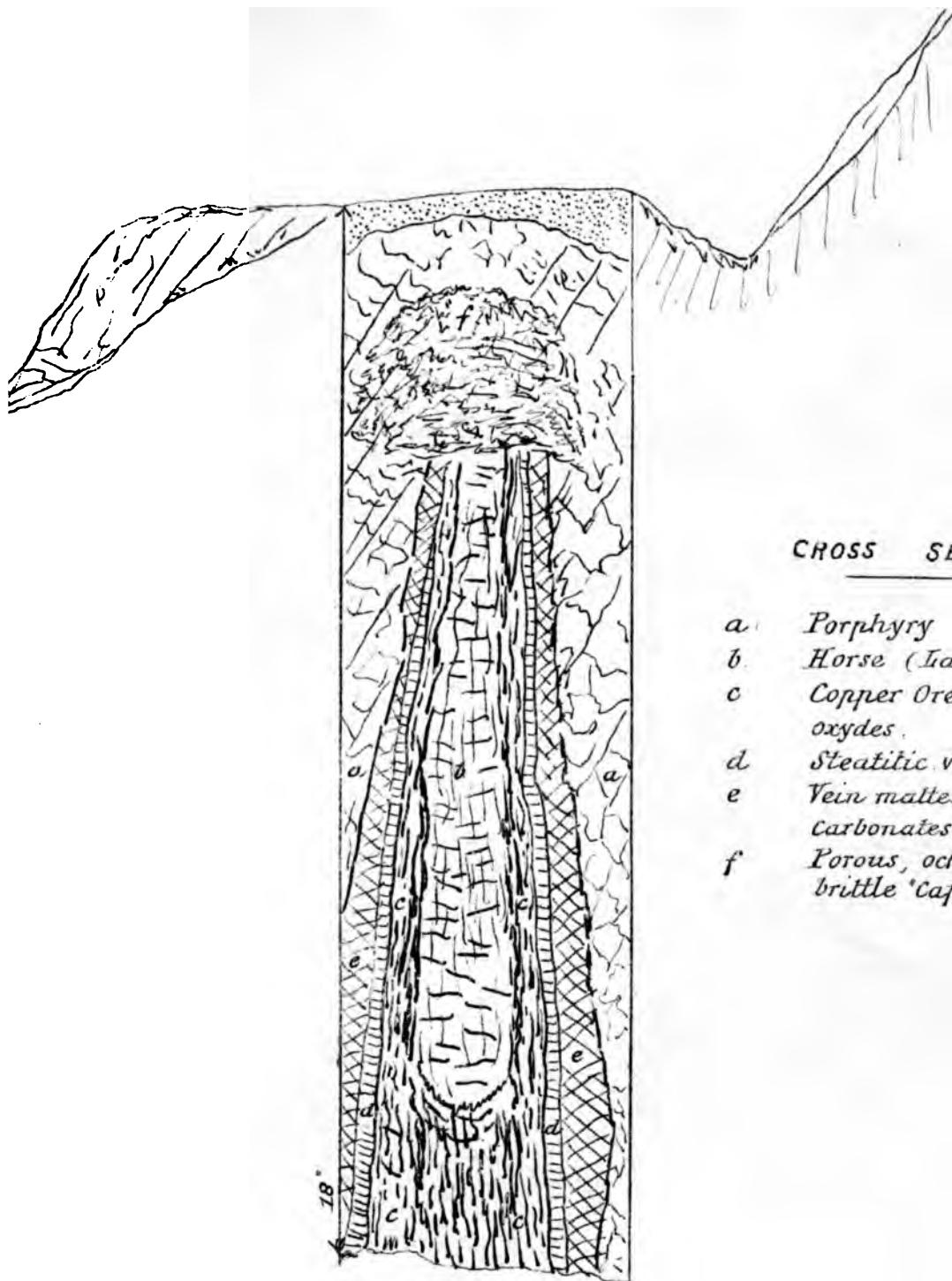
PLAN N°6.



1. Sketch at Second Waterfall
a. Metamorphic Schists (dioritic)
b. Porphyritic (with Garnets)
c. Argentiferous Lead Ores.



DEVON CONSOL COS MINE .
PLAN N^o 8



CROSS SECTION Sketch.

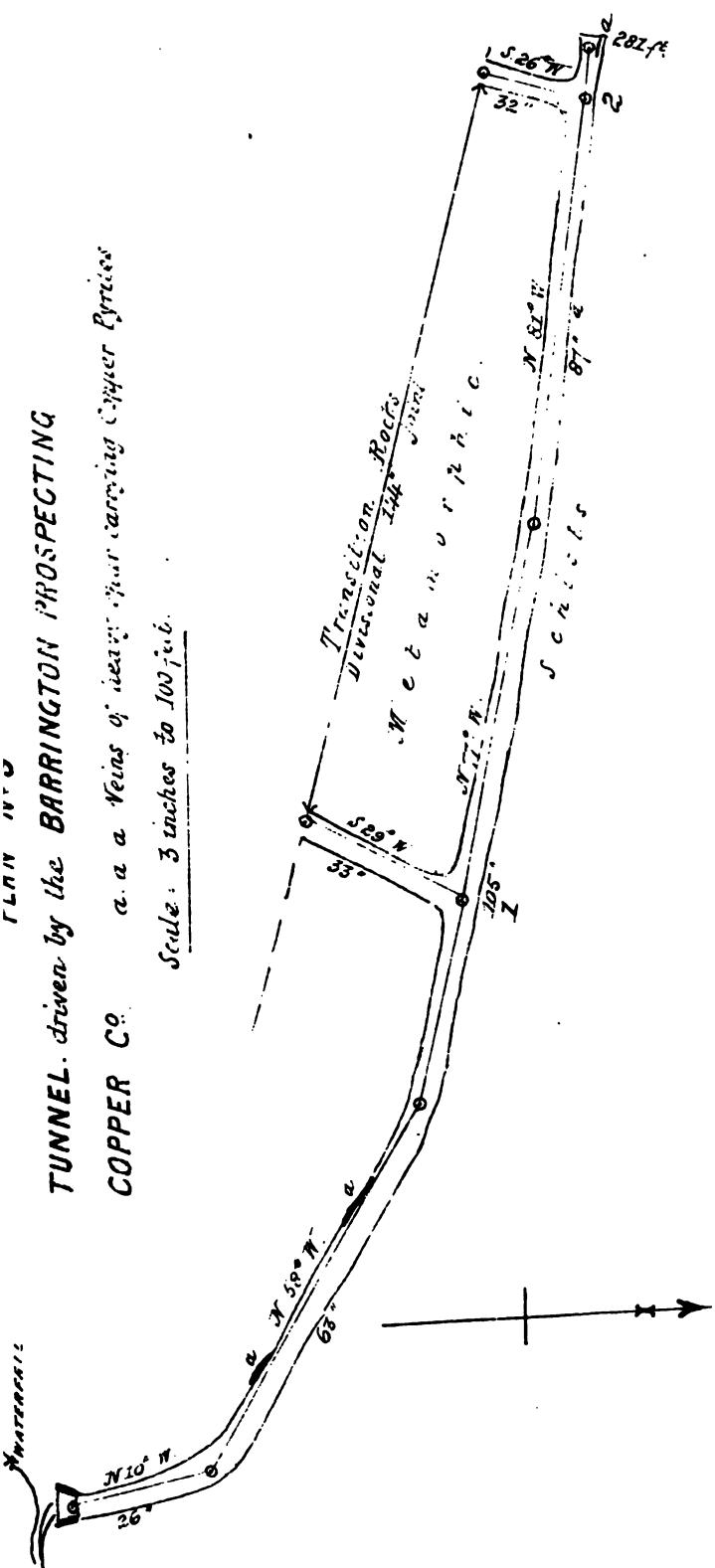
- a Porphyry
- b Horse (Iava)
- c Copper Ores = Grey and black oxydes.
- d Steatitic vein matter
- e Vein matter stained by Copper carbonates.
- f Porous, ochreous, and brittle "cap" of vein.

WATERFRONT 17

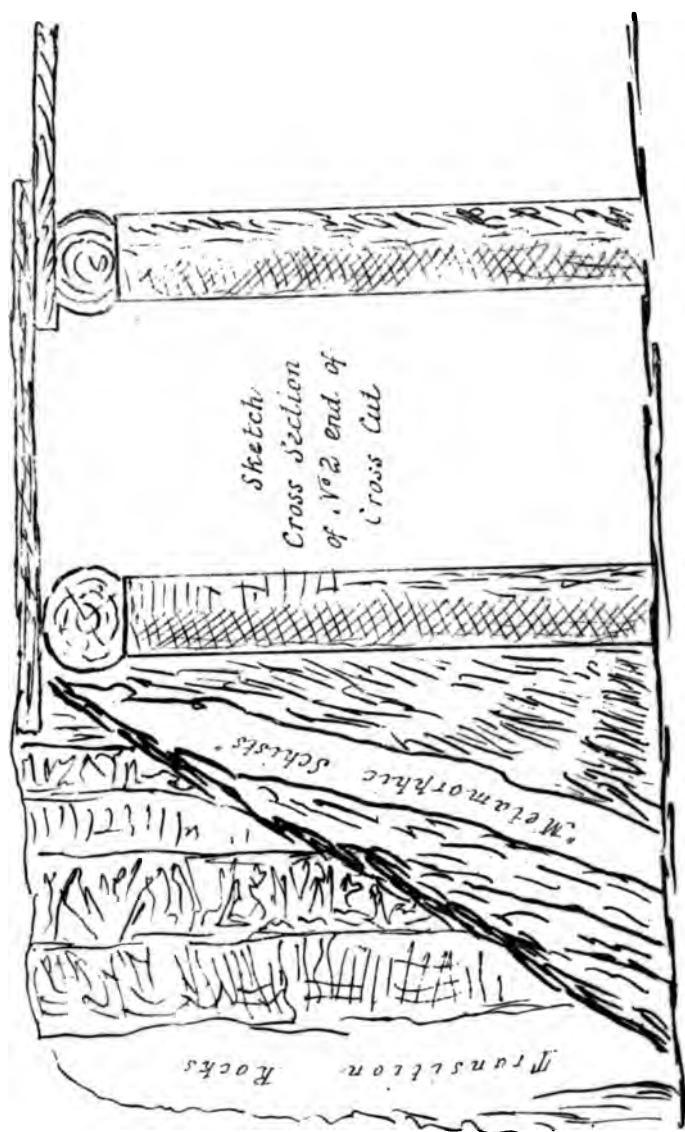
TINNE/ driven by the BARRINGTON PROSPECTING

COPPER CO. *as a means of interest in carrying copper particles*

Scale: 3 inches to 100 feet.



J.C. Branner.





J. C. Kranner.

(No. 45.)



1882.

TASMANIA.

HOUSE OF ASSEMBLY.

BACK CREEK GOLD FIELD:

REPORT BY MR. THUREAU.

Laid upon the Table by the Minister of Lands, and ordered by the House to be
printed, July 12, 1882.



REPORT on the future Prospects, as regards Productiveness and Permanency, of the BACK CREEK GOLD FIELD, County of Dorset.

THE principal range of this district, near the Sir John Franklin Gold Mining Company and the slate quarries, is located 95 feet above the summit at Lefroy, or 415 feet above sea level.

Geological Features.—The formation of rocks principally belongs to the Silurian era, consisting of soft to hard, light to dark coloured sandstones, which are distinguished by massive bands or beds of slate of good quality and colour. The district has been proved auriferous, both in the vein quartz and in the gravels, especially the latter; and the gold found in the alluvial is mainly confined to a series of leads (gutters) trending in a south south-easterly direction. These, properly speaking, diluvial leads have frequently been very remunerative to work, and operations came to a standstill only upon their digging beneath flows of basalt which overlay all these "runs" of gold, which constitute a system of ancient or pre-historic river drainage.

So far, quartz mining has not been sufficiently remunerative or successful as the indications would warrant the miners to anticipate; and beyond those gold-bearing veins in the vicinity of the Franklin Company other veins of quartz were found too poor, though the heavy gold, at the "White Lead" for instance, is of so quartziferous a character as to indicate a reef at no great distance from that rich deposit of gold. There are, however, other indications in various parts of this goldfield of quartz reefs existing, as the primary source of the gold-bearing gravels worked in the beds of the ancient rivers.

The Franklin Company hold a lease of 18 acres, upon which several shafts have been sunk, from 67 to 200 feet in depth. Irregular gold-bearing leaders were discovered near their deep or engine shaft, which dipped first north and afterwards to the south-west, and they were from a few inches to two feet six inches in width. A great deal of prospecting and mining has been carried on, but owing to the want of a more powerful engine than the one in use (7 h.p.), the influx of water could not be mastered. As this belt of auriferous quartz has doubtless been the source from which the Albion Lead derived its gold-bearing deposits, the deeper ground, and that beneath the old workings, where the strata has become denser and more tenacious, deserves to have further tests made, and an underground diamond drill would, no doubt, solve the question whether or not these veins, leaders, and semi-detached bodies of quartz would continue so disordered at greater depths, or whether they form offshoots only of more massive and regular lodes occurring below present workings. Both in the private property (Australian Slate Company) and in the Albion Gold Mining Company's lease similar bodies of more or less auriferous quartz have been met with at various depths; but it appears that these have likewise been subjected to disturbing influences. In the private property, for instance, south-west of the Franklin Company, a number of shafts have been sunk; and in the most westerly one, at a depth of 32 feet from the surface, a ferruginous vein of brown quartz was met with. This vein, two feet wide, carries good payable gold; but a "slide" or "fault" dipping north cut the vein off or "threw" it to some distance, so that its discovery at the 67-feet level would demonstrate how considerable a disturbance these strata, and the auriferous veins of quartz they enclose, must have been subjected to.

It is doubtful whether the Albion or All Nations line of reef constitutes the source of the old Back Creek lead. In my opinion other lodes exist higher up the valley and its branches. That lead was, it will be remembered, very remunerative to work in the early days of gold mining in Tasmania.

The configuration of the district may be described as strongly resembling other well established goldfields,—viz., rounded hills, wide flats, and shallow alluvial workings, merging, however, into deeper and more confined “leads,” which are here and there severed by the more recently formed watercourses. All these auriferous runs of diluvial gravels demonstrate an immense force of water running in swift torrents in self-eroded channels in pre-historic times, as evidenced by the rounded and semi-angular boulders of a hard silicious breccia, one of which was found embedded in a reddish clay, and which measured 15 feet across by a thickness exceeding four feet, having evidently travelled over a considerable distance, as I could not discover any similar rock in the district.

All these diluvial “gutters” trend in a south-westerly direction, and here and there other smaller tributaries have been traced to their junction with either the Back Creek, Albion, or other leads. Eventually, however, it was found that they (gutters) dipped rapidly in their course, and finally a heavy influx of water interfered very considerably with profitable working, and, at the same time, a new feature still further increased the difficulties the miners had to contend with, viz., the filling in or covering of these ancient river channels by flows of basalt or lava. And as this occurred in all the four principal deep leads at Back Creek, that goldfield was partly abandoned, and only a few parties are now eking out a living in the shallower workings.

Having carefully examined this goldfield, I have come to the conclusion that, because of there being every probability of the Albion, Back Creek, Prince of Wales, and White Leads joining in one main sub-basaltic channel, to which the outlet of the “Den” goldfield could be added, the deep sinking and working of the auriferous deposits promises to be successful, if carried out with proper and powerful appliances.

On the Back Creek Lead a peculiar formation has been observed, tending to show how very similar this goldfield is to those in Australia; viz.—At first the auriferous gravels rested on the Silurian bedrocks; after a distance this bedrock dipped away suddenly, by which occurrence a gold-bearing “false bottom,” resting on a coarse boulder drift, was formed; and on sinking through this drift the regular Silurian bedrock was again found 48 feet from the surface, also carrying fine gold, and dipping south. One hundred yards south of any workings a new shaft could not reach bottom whilst sinking on account of a heavy influx of water, but in the last five feet of gravel very good prospects of gold were obtained, and the following strata was passed through,—viz., clay with heavy round gold; white and black slate, lying flat; and then the wash, furnishing good prospects of gold in the pan; finally, it was proved that the course of the Back Creek Lead would be from north to south nearly. On the Prince of Wales Lead the last shaft sunk near the edge of the basalt (as shown on plan) also yielded good prospects of heavy gold. And on the White Lead the miners, only recently, obtained very rich returns of heavy gold.

One feature deserves attention both at the Back Creek and Lefroy goldfields,—viz., that on approaching the basalt these tributaries exhibit an abrupt dip under the volcanic formations, thus, to a certain degree, accounting for the temporary cessation of the occurrence of gold at so steep an incline; no doubt lower down the main channel, and on a more even bedrock, the auriferous deposits would resume a more regular character.

A glance at the plans accompanying this Report will show that there is every prospect of another, but deeper goldfield existing here, now lying dormant; and when it is considered that, owing to the narrowness of the basaltic flows, every facility exists for proving and working these auriferous deposits cheaply and expeditiously, the total stoppage of all deep lead workings becomes a serious public question. Had the Deep Lead Alluvial Company, for instance, sunk their shaft on the northern edge of the lava, where the “honeycombed” or porous basalt and the underlying schists were easier to sink through, and had they then driven under this lava in the schists, their engine would possibly have been powerful enough to test the ground, and the cost for doing this would have been also very much less than what it has been through their sinking in hard and wet bluestone rock.

Proceeding by way of the Back Creek Bridge (Johnson’s Corner), the main bed of lava still continues, and what appears to render the indications for auriferous gravels existing beneath these basalts or bluestones (Vict.) is the occurrence at their edges of beds of indurated clays, resting on quartz gravels (rounded); the former a product of volcanic contact, and the latter of lower beds of diluvial gravels. Further on it is observable and clearly indicated, to the north of the Lorah and West Lorah Quartz Mining Companies’ workings, that this deep ground still traverses the country, which everywhere else is of the Silurian age; at those companies’ workings another rich tributary originates, dipping rapidly beneath the edge of the basalt, and then losing the very heavy gold it carried down to that point, where also water prevented further progress.

On reaching the Piper’s River (Lot 970), a distance of over three miles from the White Lead, this basaltic plateau, which has but a fall of 70 feet in that distance, it was found that that river’s bed was 200 feet deep, and that the schists could be discerned at some points both above and below, or north and south. This locality would most probably constitute the “outlet” for the Back Creek

ancient river or diluvial gravel system. On enquiry, I was informed that in the more recent fluviatile gravels of the Piper River gold had occasionally been found, which was probably derived from these older gravels through denudation. At the same time it is quite possible that that flow of basalt which follows the Back Creek north may cover an equally as deep, if not deeper channel, in which case the supposed outlet at Lot 970 would constitute an eastern tributary only, which may be the case, as the schists protrude almost uninterruptedly and at a higher level on the river directly opposite the supposed exit.

Taking a comprehensive view of the peculiar geological features of the whole region, I have come to the conclusion that this whilom abandoned gold field offers substantial encouragement to the mining capitalist for the purpose of submitting several localities to systematic tests and practical development. The channels now filled or covered with basalt are so narrow, and the fact of not less than four (or more) narrow, though sometimes rich, leads of gold disappearing beneath these volcanic flows, are more than suggestive to a practical mining geologist or miner as to their value after their junction has taken place. It would, however, not be judicious to commence operations too near the point where any of these leads have dipped under this basalt; far better to select a place lower down as already mentioned. And in this connection it would be advisable to use a diamond drill (large size) to prospect for the deep ground along the edges of the bluestone, in order to avoid long main drives. As regards the future richness of these sub-basaltic auriferous deposits, I think it is safe to infer, from the fact of the tributaries having been frequently rich, the accumulated contribution from these "feeders" should be of a similar character.

Besides the auriferous deposits described, it may be stated that native copper and its sulphurets and carbonates have been met with occasionally in various places; viz.—Native copper in the Sir John Franklin Company's tunnel, also in a clay at the head of the Albion Lead; green carbonate of copper in the upper tunnel of the Australian Slate Company, and nodules of sulphurets of copper near the same place. But as these were simply mere indications, no commercial value can be attached to the same until deposits are discovered of a more pronounced and permanent character.

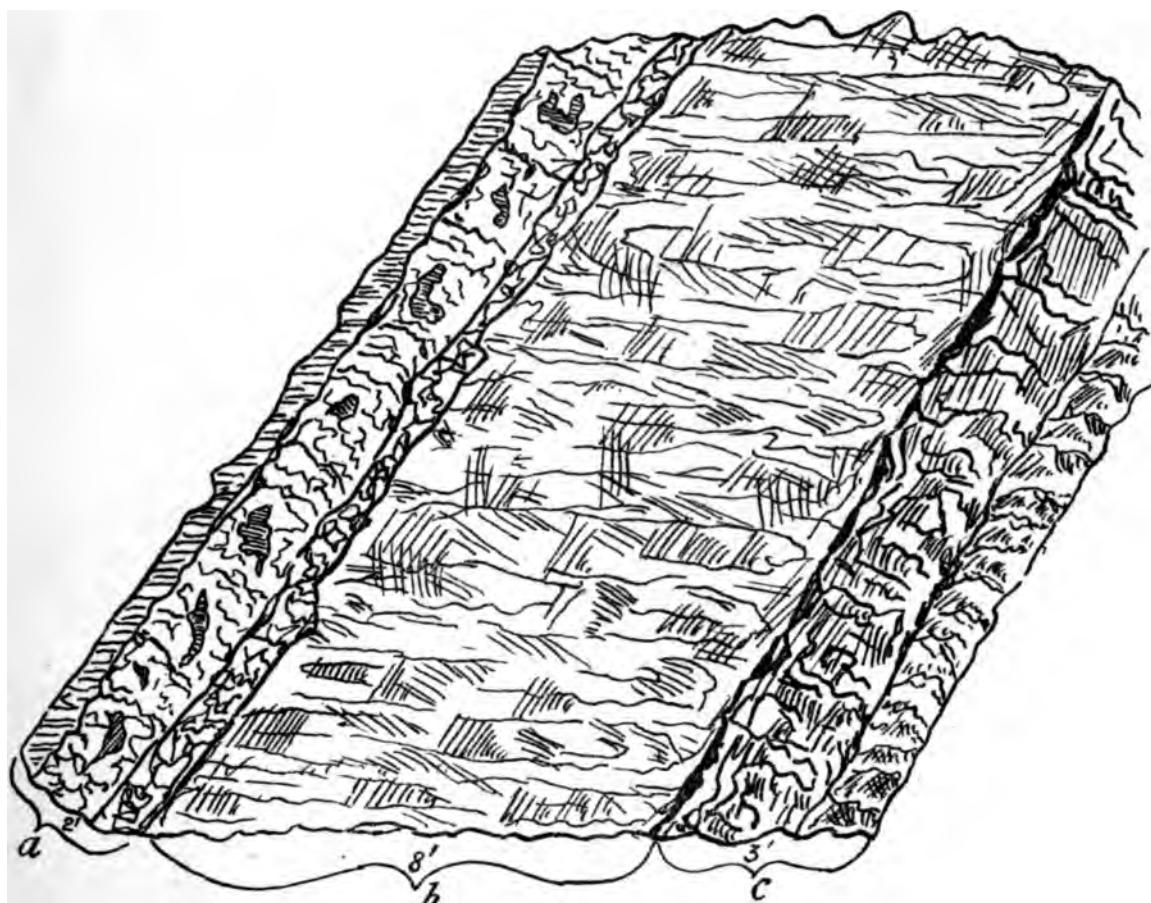
It has been stated already that the sandstones prevailing here were accompanied by massive bands or beds of slate of good quality and colour. And as these slates have formerly been wrought very extensively, a few remarks on this valuable mineral deposit cannot, in my opinion, be deemed out of place.

The slate quarries extend over a large piece of ground, and they are situated upon and along the crest of a spur running towards the northern shore of Bass's Straits, which is reached by means of a tramway. The cross-section accompanying this report will tend to elucidate the manner in which the more valuable slates occur, with a horizontal cleavage inclining slightly north-west and dipping north. Like other slate countries (Wales), these Tasmanian slates rest on a hard "back," which latter, if regular, carries good slates. In this case, however, in the whole formation of slates, whether viewed vertically or along their strike, there are several contortions which, to a limited extent, interfere with the continuity of supply of marketable slates. As regards the quality of those slates which have been got from the lower levels from regularly formed blocks, it is very good indeed, and compares very favourably with the imported article. I examined dressed slates which had been exposed to the atmosphere for over fifteen months, and they were not in the least changed in colour, texture, or fracture. In fact, comparing same with some more recently raised, the former were much improved in hardness and, consequently, durability. The manager's house was roofed with slates from these quarries over six years ago, and on close examination it was found that they had not in the least lost their durability; they showed no trace of "flaking" in the form of films, and the only change perceptible was that they had changed from a deep black originally to a more greyish colour. This circumstance cannot, however, considering their preservation during the period stated, be held as detrimental to their use in hot climates, owing to the lighter shaded slates absorbing less heat than the black.

From the formation of the country farther to the north and along the strike of the principal beds of slate, I am inclined to think that they will be less subject to contortions and irregularities, caused chiefly by quartz reefs and veins, as at present, and therefore more likely to be productive of a regular and increasing supply, as the working extends, for commercial purposes. From what I saw of the slates exposed in the workings (which were planned with great care, evidencing much experience), there cannot be any doubt that this material will yet become of considerable value to Tasmania.

G. THUREAU, F.G.S.

Inspector of Mines Office, Launceston, 24th March, 1882.



CROSS SECTION AT SLATE QUARRIES
BACK CREEK

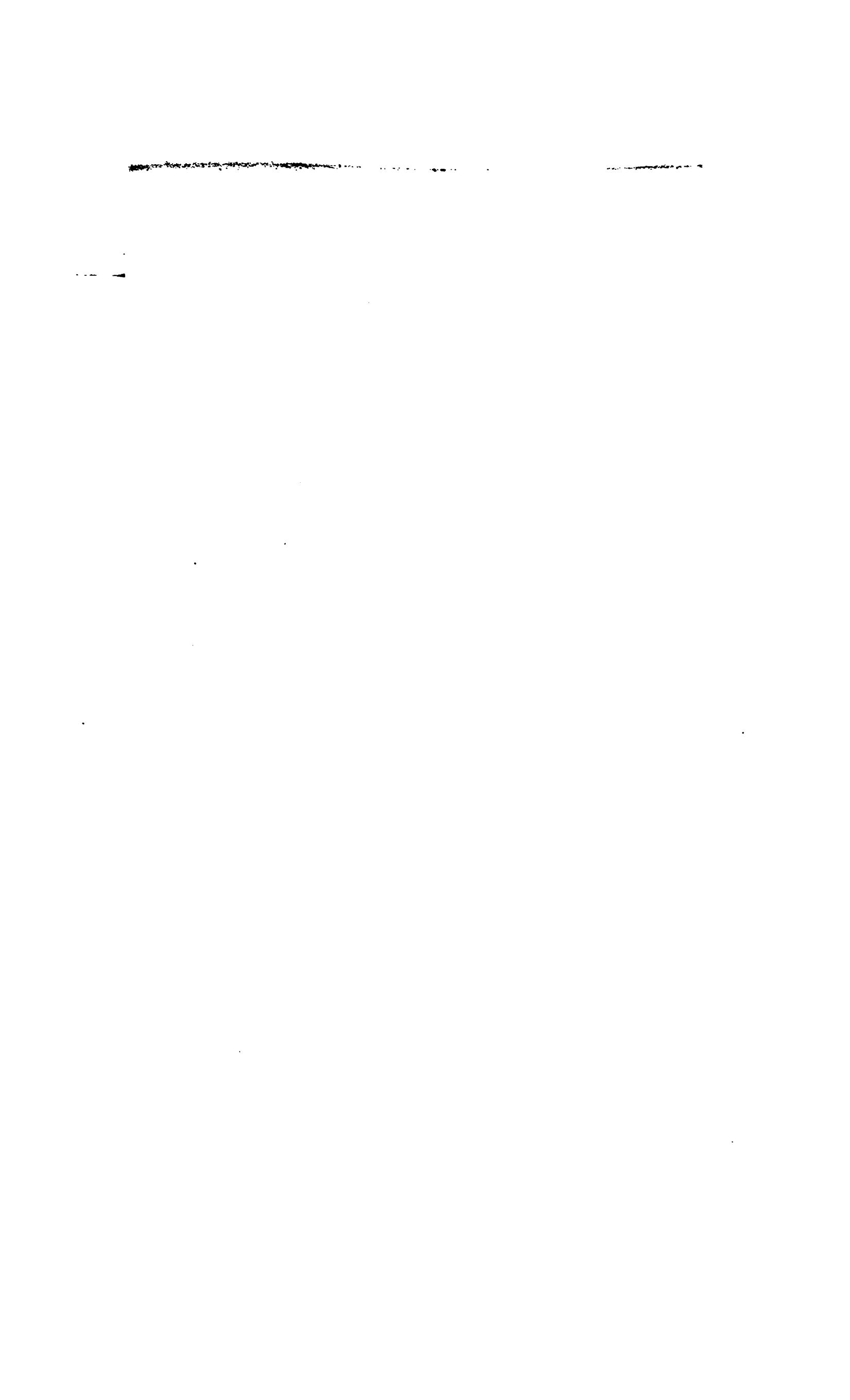
a. "post" enclosing nodules of copper pyrites
b. "band" of slate. - c. "post" (back)

G. THUREAU F.G.S.

FROM LEFT

net

FROM LEFT



J. C. Branne

(No. 44.)



1882.

TASMANIA.

HOUSE OF ASSEMBLY.

D E N G O L D F I E L D:

REPORT BY MR. THUREAU.

Laid upon the Table by the Minister of Lands, and ordered by the House to be printed, July 12, 1882.



REPORT on the Mineral Resources and Permanency of the DEN GOLD FIELD.

THIS Gold Field, of a limited area, is situated nearly due north of Mount Direction, at a distance of nearly six miles in a straight line. Turning off from the Launceston to Lefroy (or George Town) road, at the second bridge over the Fourteen Mile Creek, and following a track in a north-easterly direction for about two miles and a half across a portion of a large surface depression or basin, a fringe of low ranges is reached, which form a connection with all the other ranges surrounding the basin referred to. The drainage of the region is principally by way of the Fourteen Mile Creek, and the strata consist of recent tertiary clays and drifts. Judging from the formation of this basin, boring for water in Artesian wells promises to be successful. Those ranges which enclose the Gold deposits at the "Den" exhibit at the surface, at the foot, a coarse boulder drift resting on thin-bedded Silurian sandstones and slates. The Fourteen Mile Creek observes a nearly true North from South course, and over twenty years ago gold was found here in the alluvium, which latter averaged from 6 to 20 feet in depth. The yield of gold was, as far as could be learned, pretty good, and the extent of the field for alluvial gold was found to be about a mile along the course of, and in the bed of the creek. Owing to the periodical scarcity of water for mining purposes, the ground has been wrought chiefly by driving in the lower auriferous gravels from numerous shafts sunk for that purpose, but it is held that the whole of the valley deposits now remaining would pay if manipulated in hydraulic ground sluices. I was informed that to bring the water on to this field at a sufficient elevation in order to obtain the pressure requisite was estimated to cost nearly twelve hundred pounds; at the same time the parties averred that it would not remunerate them to do so, because they could not obtain, as in New Zealand and Australia, those extended areas of ground granted under miners' rights in those gold-producing countries, such ground having been abandoned by the miners for a considerable period.

The gold obtained was generally of the coarser kind; and near where the ranges came closer together than above or below, at the creek, some gold was discovered attached to quartz, and on tracing these auriferous specimens it was found that the gravel or wash containing same trended up the sides of a low hill, on which eventually an outcrop of gold-bearing quartz or reef was discovered. About twenty feet were sunk on this auriferous quartz some years ago, and it is only recently that a co-operative prospecting company—the only one now carrying on mining operations at this Den Gold Field—have been sinking a new main shaft 20 feet west of the old reef, in order to test by same that stone at a lower level. They were 50 feet down from the surface at the time of my inspection, and after, through some flat leaders from one to six inches thick, an aggregation of vertical quartz leaders, altogether two feet wide, was met with near the bottom of their shaft. As the old reef underlays as one in three feet, it is probable that in other ten or fifteen feet it may be met with in sinking this new shaft. Those leaders that were intersected hitherto, though interspersed through and impregnated with arsenicates and sulphurates, are thus far non-auriferous. In another shaft located still higher up the hill gold has, it is said, been found in quartz, and the nature of the country or wall rocks in which the old reef occurs is favourable to auriferous deposits in quartz, the upper Silurian schists which comprise the rocks mentioned being more than ordinarily well defined and bedded. Amongst these, a deep black soft band of slate (talcose), which possesses all the properties of a good writing material, was found here, and erroneously termed "a vein of plumbago" by the miners. The influx of water from the quartz leaders is, however, very heavy in the prospecting shaft; and should the reports be accurate as to the auriferous character of the old reef, there are indications in other localities not far off which deserve the prospector's attention.

G. THUREAU, F.G.S.

(No. 118.)



1882.

T A S M A N I A.

H O U S E O F A S S E M B L Y.

L E F R O Y G O L D F I E L D:

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REPORT on the Mineral Resources and Permanency of the LEFROY GOLD FIELD, Tasmania.

THE principal rocks comprise at the surface soft light-coloured sandstones, with thin bands of slate alternating the beds. These change in depth into black dark-greyish sandstones and satiny slates heavily charged with iron pyrites. The district is formed of rounded hills, not rising above 320 feet above the principal watercourses draining the region, and which ultimately empty into the Nine-Mile Creek. Vein mining of auriferous quartz forms the principal feature of the district, though some alluvial deposits were formerly wrought with tolerable success. The country rocks are covered in places both with a detritus and a talus of considerable thickness, exclusively composed of angular and semi-angular quartz. Tertiary washes exist also in close proximity to flows of basalt, which overlay these deposits. The continuance of these "auriferous" pliocene gravels has been proved beneath the basalts at considerable depths, thus demonstrating the permanency of these hardly sufficiently tested deposits. There is an absence of any other eruptive or intrusive rocks in this neighbourhood, except, perhaps, a dyke of feldspathic granite on the road to and half-way from Lefroy to George Town.

The quartz reefs are found in very peculiarly foliated silurian schists, already described, and without very close observations the nature of the "wall-rocks" to the quartz lodes cannot be understood.

At first sight these schists appear to occur in very thinly laminated beds, exhibiting a wavy texture throughout, and almost horizontally deposited. They are traversed by subordinate, more or less vertical, joints closely resembling the carbonaceous forms of strata. After a more extensive survey all over the district, however, I found that these beds formed a portion of an anticlinal section of strata (nearly four miles across), the apex of which is moreover very much depressed and disjointed. And it is in that kind of country where, within certain zones, the Lefroy reefs occur, or, geologically speaking, in the "division of the country" so well known on the Garden Gully and other lines of reef, Bendigo. The Lefroy reefs, therefore, occupy clefts or fissures in the silurian beds; and as these lodes traverse the strata at nearly right angles, and more or less vertically, they are somewhat irregular in their course, owing to the character of the wall-rocks enclosing same.

(*Sketch A.*)—With regard to the tertiary gravels, it may be observed that a prominent eminence, immediately east of the New Native Youth line of reef, and close to where the East City of Launceston G.M. Co. used to carry on their operations from a now abandoned shaft, is capped by an older tertiary drift (pliocene), but so far no attempts seem to have been made to prospect same for gold, which may probably exist where, nearer the creek, this wash rests on the silurian bedrock.

(*Geological Plan B.*)—The principal valley, Sludge Creek with its northern course, near the quartz reefs, exhibits both the detritus and the pliocene gravels within a short distance only of the edges of a ferruginous band of mottled red to brown clay, which overlies those pliocene gravels, the former being in turn overlaid by a blue mottled clay, both beds being occasionally overlapped by the detritus (recent) referred to already. These characteristic beds of blue (dark) mottled clays resemble much those formed of volcanic ashes and "scoriae" so frequently occurring with deep diluvial gold deposits in other gold-producing countries, viz., Australia and California. A change of soil denotes here, the same as elsewhere, the presence of other strata; a rich, porous, though stony chocolate-coloured earth gives evidence of a decomposing highly-crystalline lava, i.e., basalt, existing hereabouts. It is of a deep green colour, owing to an admixture of this rock with "olivinite," besides enclosing in its vesicular cavities crystalline species of the Zeolite group of minerals.

At the sides of the valleys or creeks the ranges still exhibit the silurian schists with their covering of quartz detritus, the older tertiary drifts having been buried beneath the subsequent flows of basalt now covering or filling the original pre-historical, and much deeper valley. These basaltic flows,

passed, doubtless, in their igneous liquid state over the tertiaries, and became solidified, and there is consequently every probability of those pliocene gravels, as the result of abrasions and denudations of the Lefroy reefs, having become auriferous; on the road to the Back Creek, these tertiaries in fact, where deprived of their volcanic coverings, have been sluiced to a considerable extent at the edges of the deeper channels.

(C.)—On the plan of leases accompanying this report, it is shown that a shaft had been sunk to a depth exceeding 100 feet through hard basalt without reaching either the wash or the bed-rock, thereby indicating a considerable depth in the pre-historic valleys in that vicinity.

Of the quartz lodes, the New Chum "line of reef" may be cited as the more regular and continuous in this locality, though, of course, the behaviour of this lode is also subject to various changes as to width and metalliferous character, which are in accordance with the varying nature of its wall-rocks, but, on the whole, it may be stated that the reefs at Lefroy are, in my opinion, "true fissure lodes," and, therefore, more likely to prove permanent in depth and strike. This view is supported by the fact that no primary rocks (granites) occur in large quantities in the vicinity, which latter in Tasmania have already had the effect, singularly enough to record, of causing a gradual transmutation of auriferous quartz into an almost exclusively stanniferous and cupriferous veinstone.

The plans, sections, and diagrams furnished for elucidation of this report will exhibit the peculiar features observed: it is satisfactory to note also, that, although the petrifications could not be discerned for purposes of classification, the metalliferous properties of the lodes do not appear to afford evidence altogether unfavourable to their continuing to do so, similarly as they do now, at greater depths.

With greater depths, however, it is quite clear that the density and tenacity of the country rocks materially increase, consequently mining operations are not only greatly retarded but become much more expensive. On that account principally, and manual labour adding so much to the cost of raising and reducing the quartz, the deepest level at any Lefroy mine (600 feet) has been abandoned for a time. With the assistance of the modern percussive rock-boring machines worked by means of compressed air, fully 50 per cent. more work can be done in a given time, and at less expense, than manual labour, so that these levels, if driven at so much greater speed, if they once intersected gold-bearing stone which would not pay with manual labour, would leave a profit beyond expenses.

The veinstones, auriferous in character generally, richer where "shoots" of gold traverse the lodes, do not at Lefroy exhibit any material decrease in width or extent along their strike, certainly not more than at other quartz-mining centres; but at the same time it is to be deplored that a system of mining has to some extent obtained, which is detrimental to the future stability of this district, the same as it has been at other quartz mining districts. I refer to the exhaustion of the gold-bearing veinstone in some cases, in the stopes of their lowermost level, *before* another and deeper level is opened for stoping. The effect of this pernicious procedure may be stated as follows:—By the time that the yet remaining ore in the stopes approaches exhaustion, the yields gradually fall off, and the stocks recede in price or value: with greater depth, more powerful pumping and winding appliances for carrying on mining at still lower levels become a necessity, and as all previous profits have been divided amongst the owners, calls are requisite to cover that outlay, inducing thereby a feeling of insecurity that should not exist were a more judicious system adopted and observed. In other quartz-mining centres this "raking" out of the richer stone, with its unpleasant consequences, had to give way to the "continuous" sinking, cross-cutting, and generally developing of their mines, in the first instance, followed likewise by a judicious "blending" of the richer with the poorer class of quartz, thereby ensuring average and certainly much more satisfactory results. In making these remarks it may also be pointed out that this present system has another and even more serious result, because, on opening a deeper level, should it be found, as is very frequently the case, that the stone is much poorer than it was in the levels above, such an occurrence will induce a belief throughout the mining community and the colony at large contrary to the permanency of the gold continuing in our reefs to great depths, notwithstanding the experience, mostly to the reverse, of such in Victoria, California, and Nevada.

From north to south there are at present seven principal lines of reef that have been proved gold-bearing (more or less),—

1. Hackett's.
2. New Chum.
3. Native Youth.
4. Golden Point.
5. Prince of Wales.
6. Star.
7. Caledonian.

Besides these, there are others, such as the Shamrock, Birthday, which have been abandoned for some considerable time.

The *Hackett's* line of reef is situate about $1\frac{1}{2}$ miles north of Lefroy township; it occurs in a soft white to reddish argillaceous slate and sandstone (upper silurian), which is besides traversed by numerous veins of white crystalline quartz. A considerable number of small shafts have been put down on its course to various depths, not exceeding, however, 64 feet. The reef so near the surface is narrow, and it underlays to the south. Judging from general indications, the auriferous quartz forms most probably a portion only of other and parallel veins not yet discovered. The gold appears to occur in that characteristically crystalline quartz, without much regularity, but very rich specimens have from time to time been found in this reef. Inducements are held out for prospecting the ground by means of crosscuts, and the sinking to greater depths, where in the harder strata those veins may consolidate into a more compact body of auriferous quartz.

THE NEW CHUM LINE OF REEF.

This lode presents all the features generally observed with regular gold-bearing veinstone. Not only has this lode been proved auriferous at or near the surface for a very considerable length along its strike, but it has every appearance of so continuing until overlaid either by the carbonaceous sandstones, or the basalt occurring nearer George Town. Gold-bearing stone, more than payable, has likewise been traced to a good depth, viz., the 270 feet level.

The quartz exhibits a highly mineralised and laminated character, and the gold is well distributed, though in several shoots of gold it is even more richly apparent. These shoots of gold in traversing the body of the lode dip at certain angles, thus leaving the spaces intervening between the shoots comparatively poorer, if not barren. The width of the payable stone varies on the average from less than a foot to 10 feet, and the bearing of strike ranges from E. 6° N. to as much as E. 15° N.

After examining the mines where on this line of reef actual mining operations were carried on connected with the winning of ore, I would observe that there were three complete winding and pumping plants of ample steam power at work, sufficient to reach eventually levels from 500 feet to over 800 feet in depth; of these three companies, one was crushing the quartz raised in their own batteries; two others were erecting their own crushing machinery, one of which was meanwhile crushing at the New Native Youth Company's batteries; and farther west still, two other proprietaries were engaged in the erection of winding and pumping plants, thus exhibiting a scene of great activity not often met with, and evincing at the same time the strong confidence those interested have in the New Chum reef. There were at the same time three or four large shafts going down at considerable distances in advance of those that had already proved the continuance of this gold-bearing reef in their respective leaseholds.

The East New Chum Company.—At their only level, 240 feet in depth from the surface, which is, however, 40 feet deeper than that of the adjoining New Chum Company west, the New Chum reef was intersected in a crosscut driven south from the shaft at a distance of 23 feet; the lode was narrow there, but has increased considerably in the western level, and exhibits payable gold. A winze was sunk below this level to a depth of 26 feet, in which a somewhat larger stone, also showing some gold, was followed.

The New Chum Company have opened their ground or mine from three different levels; viz., the No. 1, at 120ft. from the surface, at which depth the reef was intersected in a crosscut driven 60ft. south; the No. 2 at a depth of 180ft., also with a southern crosscut 68ft. 6in. in length to the reef; and the No. 3 at 240 ft. with a crosscut of 78ft. south. The difference in the surface level will account for the otherwise seemingly corresponding depth of levels in these mines, which, in reality, are widely separated, through the various levels differing from datum level.

The lode at the lower level in the "east" end was fully 5ft. in width in the back of the drive, and 2ft. 6in. in the bottom, increasing, however, to a width of 8ft. in the back of the first stope above. Judging from the general appearance of the New Chum reef in this mine, it may be observed that the quartz shows a very good character for gold. The reef consists of crystalline quartz, in which numberless angular fragments of the wall-rocks are embedded, and it is besides highly mineralised by both arsenical and iron pyrites, chalco pyrites being less frequent. The average gold yield has been very satisfactory for the owners, to whom an amount of £57,250 sterling has been disbursed in the way of dividends. The company have erected a separate and powerful pumping plant, leaving their other engine to do the hauling exclusively. Tenders have likewise been accepted for the supply and erection of a 15-head battery, to be furnished with all the usual modern gold-saving appliances. This will enable this company in a short while to dispense with the contract entered into with the New Native Youth Company for crushing at their mills, where at present the quartz is delivered at a fixed price by means of a tramway about three-quarters of a mile in length.

The West New Chum Company, immediately west of the last, are carrying on their underground operations at a deeper level than any other on this line of reef, and their shaft is still in the hands of the "sinkers."

Their lowest level was opened at 270ft. from the surface, and the lode was intersected in their southern crosscut, at 95ft. from the main shaft. The surface appliances comprise, besides winding and pumping engines, also an effective crushing plant, all of which are in good repair, and kept in a good working condition.

The main shaft is divided into three compartments, one for pumping and footway, and the two others for winding, with trucks and cages. All the principal workings are secured with strong timber, whilst the exhausted stopes have been properly filled with loose rock, thus ensuring safety from collapse of the workings. In this, as well as the last mine, the managers have utilised old shafts and winzes for the purpose of securing, besides the ladders in their respective pump shafts, independent footways or ladder roads from their bottom levels to the surface. This is a valuable means for escape in cases of possible collapse in the workings, whilst at the same time the ventilation of the latter is considerably improved. As far as their portion of the New Chum lode is concerned, it partakes of the general character observed in the two mines just described, the only and peculiar feature worth while referring to in this connection being the gradual curving of the vein in the centre of the lease towards the south from the western and eastern boundaries (D.) Besides there occur no less than three distinct shoots of gold, which dip at angles varying from 40 to nearly 55 degrees in their declination to the west. Between these richer channels, so to speak, of stone an apparently almost barren quartz forms the intervening portion of the New Chum reef. In their lowest level (270ft.) preparations were being made for the erection and fixing of an underground "balance-bob" or "beam," which is intended to take the weight of the rods and pumping gear working above this station or plat. For this purpose a chamber was being excavated opposite the ordinary working plat in which the above balance-bob, having a beam 24ft. in length, could be securely fixed and bolted to its properly massive foundations. Above the next higher level but little really remunerative stone remained in the stopes, thus illustrating what has been observed above on the same subject, but below that level in a winze very good quartz has been followed downwards. The lode has since been intersected in the 270ft. level, or No. 4, and in that crosscut (95ft. in length) about midway a gold-bearing spur has been met with, whilst the lode itself has been parted into two distinct bodies ("legs"), the one nearest the shaft (north) being almost vertical, and the other (south) having an underlay in that direction of nearly 70 degrees.

As this feature has been observed in the eastern stopes, its regular occurrence at the point of intersection in the crosscut was necessarily anticipated. This company have also distributed £22,000 sterling in the shape of dividends.

The West New Chum Extended Company are preparing for the erection of a steam plant, and meanwhile mining operations were suspended at a depth of 189 feet in their shaft.

The South-West Chum Company were also idle; their shaft had reached a depth of 200 feet, and machinery would be requisite to overcome the influx of water.

The Great West Extended New Chum Company ("Boys") have sunk two shafts. Of these two their old shaft was 260 feet deep, and they had opened at the 250 feet level. Their new whim shaft had reached a total depth of 140 feet, but at that level they had so far failed to intersect the continuation of the gold-bearing stone which was found at the 100 feet level in the old shaft, though they had driven along the reef for a distance exceeding 100 feet in length. The gold-bearing stone measured from 6 feet to 8 feet in width.

The United Chum Gold Mining Company intersected the lode in their whim shaft at a depth of 220 feet from the surface, where the reef presented a very promising appearance, being of a nice friable character, full of pyrites, and carries good profitable gold. They are sinking a new main shaft from beneath, 82 feet in depth, such shaft measuring 10 feet by 3 feet 6 inches in the clear of timber, and divided into three compartments. Pending the erection of winding, pumping, and crushing machinery (since completed), all underground operations are stopped, except the sinking of the main shaft, which is carried down by means of three shifts of experienced miners.

The plant in course of erection consists of a 16-inch cylinder crushing engine capable of working 15 heads of stampers, of which 10 heads will be started, with one 14-inch cylinder engine for winding and pumping purposes. An extensive dam has been built close to the mine, from which the batteries and steam boilers will be supplied with water by means of open cuttings and a tunnel 190 feet in length. The preparations for mining and for the reduction of the quartz are on a plan which cannot fail to give satisfaction, as the nature of the quartz admits of a larger quantity being crushed in the batteries than is usually the case.

The remaining quartz-mining companies located still farther to the west on this line of reef are exclusively engaged in sinking main shafts to considerable depths, with the intention of intersecting the New Chum lode by means of crosscuts. All of these, with one exception, which is using a whip for raising the *debris* mined to the surface, are employing horse-whims for that purpose, which entail, of course, a treble relay of horses and drivers. Considering that horsefeed is dear and fuel cheap,

and that the miners are able to break out the rock in such quantities that exceed the ability of the horses to raise in a given time, and finally, that in cases of bursts of water on intersecting the reef at low levels the miners are in danger, it becomes a very grave question for careful consideration by those who may have the control of these mines, whether it would not be safer, cheaper, and more judicious on their part to employ suitable steam winding engines instead of either horse whips or whims.

The Ryhope Gold Mining Company are sinking their shaft from below the 180 feet level. The dimensions are 8 feet by 3 feet in the clear, and it is divided into three compartments, including one ladder-road. They employ four miners, and raise their *debris* by means of a whip.

The Band of Hope Company are sinking by means of a horse-whim below the 150 feet level. Six miners are employed below, three on the surface, besides three drivers.

The United Chum Extended are also sinking, and had reached a depth of 118 feet from the surface. Their shaft measures, in the clear of timber, 9 feet by 3 feet 3 inches. It is divided into three divisions, and worked by means of a horse-whim.

The Consolidated New Chum Company are located farthest west on this line of reef, and they are sinking a finely timbered main shaft from beneath the 140 feet level. The dimensions of this shaft are as follow:—10 feet long by 3 feet 6 inches wide, which will enable them to cope with any quantity (however large) of quartz or *debris* to be raised by suitable steam machinery. At present they are doing this work by means of a well-built and strongly stayed horse-whim, which may suffice at the present; but eventually stronger and more rapid means will have to be adopted. The sinking has been through hard slate and sandstone, in which some quartz veins were discovered of a non-auriferous character however, because the auriferous channel of country is supposed to occur at a considerable depth beneath those spurs.

It will be seen from the above that, out of 11 mining companies, not less than five have proved the New Chum reef as gold-bearing and profitable to work, the remaining six companies being in a favourable position for soon proving the value of their respective leaseholds in a similar manner. This extension of auriferous quartz at so inconsiderable depths cannot, in my opinion, be held otherwise than as equally reassuring and satisfactory as the continuation of rich quartz down to the 270 feet level; and so far there appear to be no indications at that extreme depth (though moderate in comparison with lodes in other quartz mining centres), which could be taken as detrimental to the future prosperity of this lode.

Proceeding farther south, the Star line of reef is the next that occurs at Lefroy, but as there was very little work carried on at the time of my inspection, nothing very positive could be stated regarding the prospects, though profitable gold has been found, I understood, in several parts of this lode. Of the companies that were at one time at work, that of the East Morning Star were about to resume operations, their steam pumping and winding plant being overhauled for the purpose. Their shaft is 200 feet deep, and in a crosscut 30 feet to the south a reef nearly 4 feet wide was intersected. It was found that the richer run of quartz would yield over $1\frac{1}{4}$ ounces of gold to the ton if kept separate, but by taking the whole reef on average 8 dwts. of gold had been obtained.

The Native Youth reef is about the oldest quartz lode that has ever been opened in Tasmania; it has been worked along its strike for a considerable distance, and the underground workings are of a very extensive character. Out of quite a number of leases as delineated on the geological plan, and also on the plan of leases of the goldfield of Lefroy, only one or two are really carrying on active mining operations, thereby restricting, it will be granted, the possibility of fresh discoveries. A number of these leaseholds have been amalgamated, not only on the Native Youth line of reef, but likewise the amalgamation includes a lease on the Golden Point line, which is quite a distinct lode from the former. I found that only one main shaft was at work, at which a steam pumping and winding engine was employed, thus concentrating the underground operations within a limited area in the close vicinity of the same, leaving the outside and considerably more so extensive portions of the leases for future development whenever this amalgamated proprietary may seem fit to extend their operations.

The New Native Youth Company employs, besides the above steam plant, a first-class crushing plant for reducing their quartz raised from the mines, or that of others in the vicinity. I was informed that this proprietary had carried on their mining operations with a very considerable amount of success, enabling them to pay its shareholders from £50,000 to £60,000 in dividends. It has been found judicious generally in cases of prosperity with mining concerns, to provide for a reserve fund, in order to aid the shareholders in the future development of their property in times less propitious, whilst maintaining likewise the value of their stock. If this had been done in some cases that need not be particularised here, there is no doubt but that such a course would have proved greatly to the advantage of those interested. This mine has been opened from the main shaft by means of the following levels, viz.—at 200 feet from the surface; at 260 feet ditto; at 320 feet ditto; at 450 feet ditto; and at 600 feet. As this mine, from all appearances, is located within

the centre of the division of the country described above, the lode is necessarily disturbed in its regular course to some extent. (Sketch *E*.) There are three principal faults or heaves in this mine, which interrupt or throw the Native Youth lode from north to south 20 feet, 16 feet, and 9 feet respectively; in fact, the strata near to the lode is considerably contorted and disjointed. The laminations of the strata nearer the shafts are nearly horizontal, but they assume a more and more westerly incline west, which at their dip is nearly 45° . As will be seen from Plan *AF*, the strata not only exhibits an anticlinal dip south-west and north-east, but the bodies of auriferous quartz at or near the 320 feet level occur similarly, though crossing the wall-rocks at nearly right angles. This is specially to be noted in the drive (at the 320 feet level), which followed the faulter-cross-course at a point 150 feet a little west of north of the main level. The run of gold-bearing quartz commences to dip north and also to the south, which feature is so frequently observed with the Bendigo quartz lodes, on a much larger scale however. It may also be observed that the lode maintains its course north to 12° east, and is made conspicuous by a peculiar soft deep black vein of "flucan" (*G.*) which encloses thin veins or blocks of quartz very rich at times. Besides these, two richer and wider shoots of auriferous stone occur, which diverge in their dip from their apex located above the 200 feet level (*H.*) Besides these so very characteristic "faults," "heaves," &c., there is another peculiarity which deserves attention on Plan *AF*. It is shown that at (*B.*) this faulter, &c. is enriched by a seam of quartz for a considerable length along its north-western strike, and two small offshoots—which have a parallel strike to that of the main lode—were also observed, highly auriferous. Without the plans, sections, and sketches prepared for this report, it is scarcely possible to explain these matters very clearly, as they doubtless deserve every attention, because the indications are in the direction of undiscovered veins of quartz running parallel to those wrought up to the present time. At the same time it is also very apparent that the 450ft. level would, as it is now being extended through a very massive quartziferous and mineralised formation towards the Excelsior shaft, intersect the continuation of the auriferous stone dipping in that direction, as would also the 600 feet level if driven along the lode in the same direction.

The 600 feet level was submerged in water, and the information I obtained was to the effect that the New Native Youth lode had been driven on its course 360 feet east, and 85 feet west. The lode was a very strong formation of mineralised quartz 10 feet in width, but yielding only 2 dwts. of gold per ton. That increase in width at that deep level would be a favourable indication for greater regularity in depth, if only it were also traversed by shoots of richer stone, the same as on the New Chum line of reef. At this level* the prospects would be more reassuring had the adjacent country been prospected by means of crosscuts of good length. This would have enabled me to pronounce for or against the success of deep quartz-mining in this part of Tasmania. And as that question is of pre-eminent importance at Lefroy and other quartz-mining centres, it is quite certain that, as a preliminary step, the mining diamond-drill could be most advantageously employed to remove doubts that may exist in regard to this important problem. The steam winding and pumping machinery consists of one boiler, 27 feet long by 5 feet 6 inches diameter, and another boiler 18 feet long by 4 feet diameter, which work at 40lbs. pressure per square inch. The horizontal engine is 22 inches in diameter of cylinder, having a stroke of piston of 4 feet. This engine works both the pumps, and two spiders for flat Manilla ropes; the lifts are 8½ inches in diameter, and two plunger workings are fixed and geared at the 320 and 450 levels; the stroke being at present 3 feet only, as quite sufficient to keep the lower level free from water, though occasionally tanks are likewise used in the central division (3 feet x 3 feet 6 inches each), into three of which this shaft has been divided; the ropes have been in use for three years, and they are now adjusted to wind, if necessary, from the 1200 feet level.

The crushing machinery is worked by means of two Cornish boilers (a third is held in reserve), each of which measures 27 feet long by 5 feet 6 inches diameter, at an expense of from 30lbs. to 35lbs. per square inch steam pressure. Two coupled engines, each 18-inch cylinder, with a 3 feet 6 inch stroke, work the batteries of 40 heads, weighing 900 lbs. each head, and the drop, adopted in accordance with the average kind of quartz manipulated, ranges from 7 inches to 9 inches. The gratings have from 196 to 225 holes per square inch, and outside of the boxes the means for intercepting and aiding the amalgamation of gold consists of copper plates, mercury, ripples, blanket stakes, and ties. It is calculated that the average amount of duty for every 5 heads stands at 3½ tons of quartz crushed for every eight hours. The whole plant is very complete, compactly put together, well kept in order, and housed in. The so very requisite cleanliness in these "gold mills" is here much facilitated by the terraces along the tables and at the head of ties, being constructed of cemented floors.

The Caledonian line of reef is situated south of that dividing range which rises to 320 feet in height above the local datum level, or about 578 feet above the sea level. This lode appears to be on the same bearing nearly, if the different altitudes of the others are considered, as those of the Birthday and Shamrock farther east. The strike of same, as ascertained in the Land o'Cakes Co.'s mine, is about east 18° north, for a width of stone from 3 feet to 12 feet. It is a well-defined gold-bearing formation, embedded in blue slate and grey sandstone, so favourable to permanent auriferous

* 600 feet from the surface, and nearly 350 feet below sea level.

reefs. There are several other leases held on this line, but only one other was at work,—viz., the Caledonian,—which has had a very good return from a small parcel of quartz crushed, and they are now endeavouring to trace same to a lower level. The Waverley Co., situated between the two former leaseholds, have intersected the reef at two different levels, but so far have met with little success, though at a greater depth their prospects may be said to be good.

Neither the leases nor other holdings on the Birthday or Shamrock lines of reef were in operation, and but little authentic information could be obtained for the purposes of this report.

In connection with the auriferous vein mining at Lefroy, the concentration and accumulation of auriferous pyrites and sands after crushing has been carried on to some extent, though not quite so extensively as this branch of gold production from those ingredients would seem to warrant, there being a considerable percentage of these metalliferous substances distributed both through the quartz lodes and the adjacent country rocks. Large quantities of coarsish pyritous tailings, rich in gold, the result of older and imperfect quartz-crushing appliances, have accumulated, and they are now manipulated for gold extraction in two different ways; viz.—

- I. By grinding to a pulp in Berdan basins with mercury; and
- II. By roasting in a reverberatory furnace, and subsequently grinding the ores with mercury in Chilian mills.

With regard to the former process, it was evidently sought through reducing, by means of the "mullers" in the Berdan basins, the size of grain of the pyritous sands, and by using a copious supply of mercury throughout to fix and obtain amalgamation of the thereby liberated particles of gold. Inasmuch, the basins and the "mullers" were both constructed of iron, the more these tailings were ground with mercury the more the latter became enveloped in iron films, and the greater would be the difficulty in recovering the quicksilver. In this case, where there was but a very imperfect mode for concentration, after grinding, the loss of quicksilver must be, of necessity, very large. The loss of quicksilver by this system is, however, a matter of great importance, not so much on account of the value of the mercury, but because it usually or always indicates a corresponding loss of gold. The greater part of the mercury passing away has been ground to a fine grey slime, and when placed under a microscope or other powerful lens, it is found to consist of extremely minute globules of mercury which will not unite (technically termed "floured"); and in most cases it is so heavily charged with gold as to deserve the name of "floured amalgam," which swims on the top of water and passes away. The use of Berdan basins, with the view of reducing coarse pyritous tailings to fine pulps simply, would be most effective if the latter (pulps) were afterwards calcined in proper roasting furnaces previous to "chlorination," but for the purposes of concentration and amalgamation only the result cannot be successful, inasmuch as both gold and mercury will escape in too excessive percentages as to render the processes remunerative enough to be adopted or to be persevered with.

The second method, of roasting in a reverberatory furnace, and grinding the thereby desulphurised residues in Chilian mills with mercury, is one yet greatly in vogue in some gold-mining countries, because it gives average results, and does not require scientific training or a knowledge of chemistry; but, if considered in connection with the chlorination processes, so universally adopted in California, Oregon, Nevada, Colorado, and by one proprietary at Sandhurst (Victoria), the great superiority of chlorination becomes at once apparent, viz., that by its means upwards of 97 per cent. of the gold in these auriferous sands, as ascertained from very careful assays, are obtained as a final result.

LOWER GOLD DRIFTS.

(*Pliocene.*)

At Lefroy and vicinity these most important tertiaries comprise the auriferous drifts so extensively developed in Australia and on the Pacific slopes of America. Hitherto my investigations in Tasmania have resulted in the discovery at the West Coast of our quartz drifts (*pliocene*) at Long Plains and vicinity (*vide* West Coast Report), assimilating to the White Hills of Bendigo; and likewise the strong indications for sub-basaltic gold-drifts at the Back Creek goldfield (*vide* Report). In the first instance the drifts were largely and extensively developed; in the second case the formation overlaid by the basalts resembled the Ballarat, Daylesford, and Taradale "deep leads" of Victoria, and those of the "Alta lead," Grass Valley City, California. At Lefroy the indications have also been realised in the Golden Era Co.'s workings (I.), where, at the 170 feet level, in prospecting for auriferous quartz in a north-easterly direction from the shaft, the black clay (diluvial) was broken into at a distance of 340 feet of said shaft. The clay referred to varies in colour from black to brown, in which flakes of grey slates and fragments of fossilised woods (lignites) are embedded. The company continued their main drive at nearly the same level in this wash for 60 feet farther, when they again met with the rising silurian bedrock. Several shafts were sunk below the level in this deep diluvial channel, by means of which it was ascertained that the bottom existed some 15 feet lower, or about 185 feet from the surface. The gravelly wash is yet irregular; very large rounded boulders, chiefly of quartz and sandstone, occur above and below the lignites, demonstrating very considerable fluvial action in pre-historic geological times. The pan prospects

obtained from the western sides of the channel were satisfactory, as they gave coarse heavy gold of a very high quality, the other residues being chiefly composed of iron pyrites, which are prevalent in the lower stratum of the wash. The workings were carried on under considerable difficulties, as the workings in the washdirt were beneath the main level, and therefore devoid of a good circulating ventilation; the water was also troublesome. Bearing to the north east the diluvium changed considerably to a light greyish clay deposit; higher up the "lignites" became larger; stumps were met with also; and all these fragments of trees, &c., singularly enough, exhibited on being broken up at the surface the original white to yellowish colour and fibres of wood; but they soon blackened, and eventually fell to pieces on being exposed to the atmosphere.

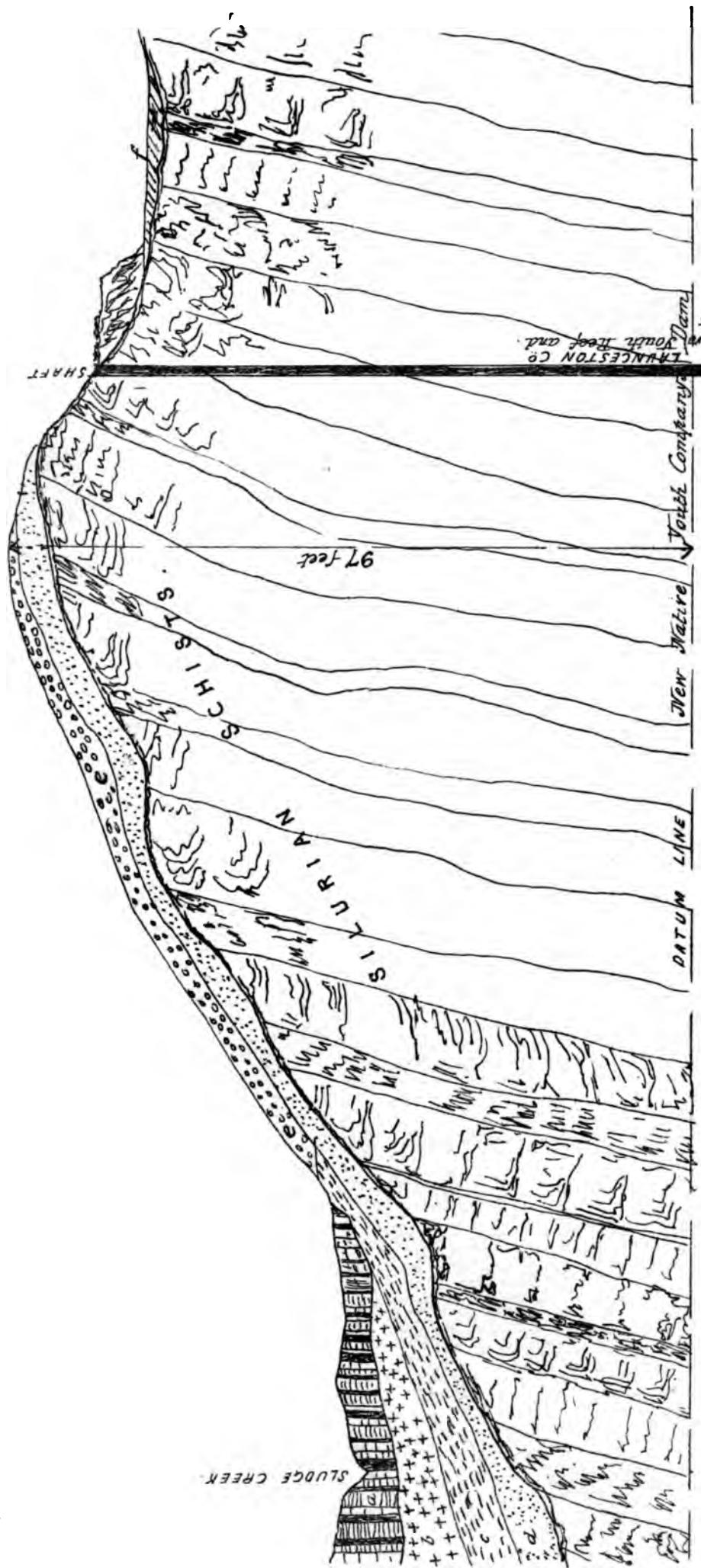
It would appear as if the main washdirt drive was approaching much deeper ground, and that so far only a bend of this diluvial channel had been crossed. However, enough evidence has been obtained for proving the auriferous character of the gravel met with at the higher ground of the channel, and such should be encouraging to the Company to test the ground at still deeper levels with the aid of steam machinery of sufficient power. It has already been stated that the basalt has been sunk into over 100 feet in depth, and that shaft is located only 16 chains east of the Golden Era Co.'s shaft, so that there are good indications for extensive sub-basaltic auriferous channels existing here, besides others that are shown on the geological plan of the Lefroy goldfield.

ALLUVIAL GOLD GRAVEL.

Between the Hackett's and the eastern extension of the New Chum lines of reef, a shallow deposit of alluvial (recent) gold washdirt is being wrought with satisfactory results. The sinking does not exceed 30 feet in depth, and the gravel is easily mined. It is probable that this deposit forms the upper end of a tributary to the much deeper ground south, and of its having been derived originally from either those two reefs or any other not yet discovered by the Pinafore Company, who have been prospecting for a lode in close vicinity to this deposit.

G. THUREAU, F.G.S.

CROSS SECTION.



Reference. a. Basalt. - b. Blue Mottled Clay. - c. Brown Mottled Clay. - d. Tertiary Drift.

e.e. Angular Quartz Detritus. - f. Alluvial (art) gravels.

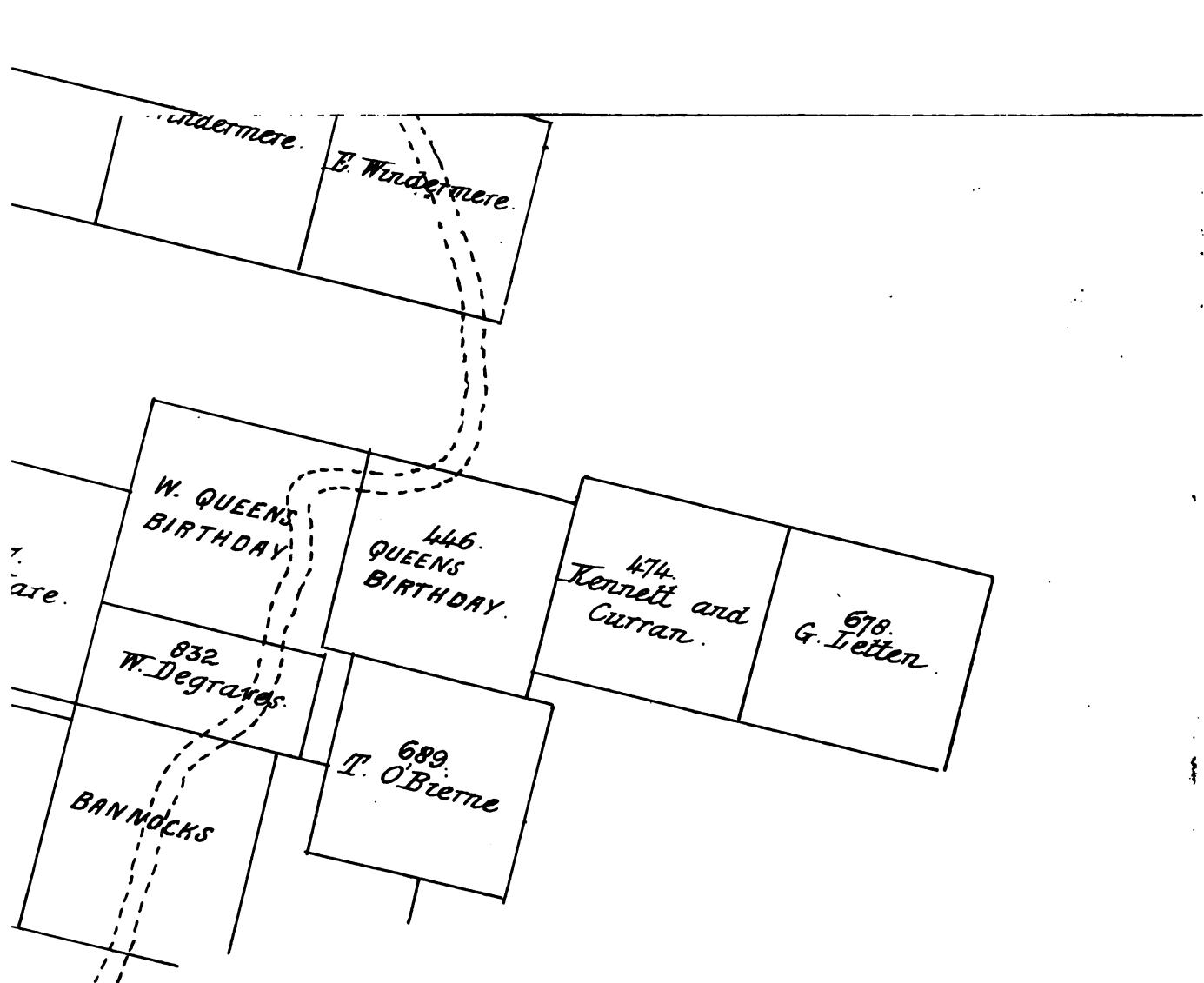
Mark for the New Dam, South Tree and fence by cross-drives

Turnceston Co.

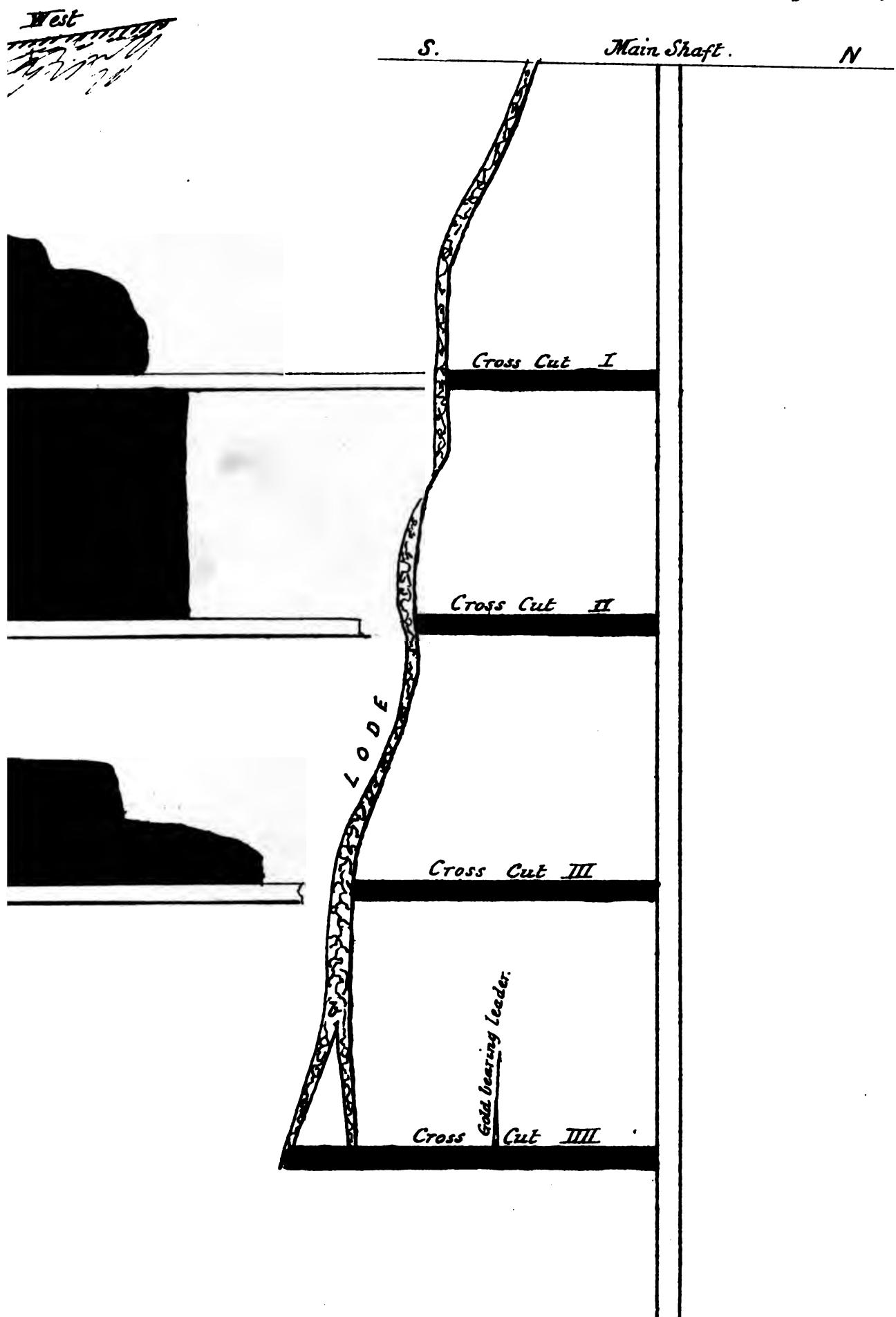
Hart, East City of

B

C

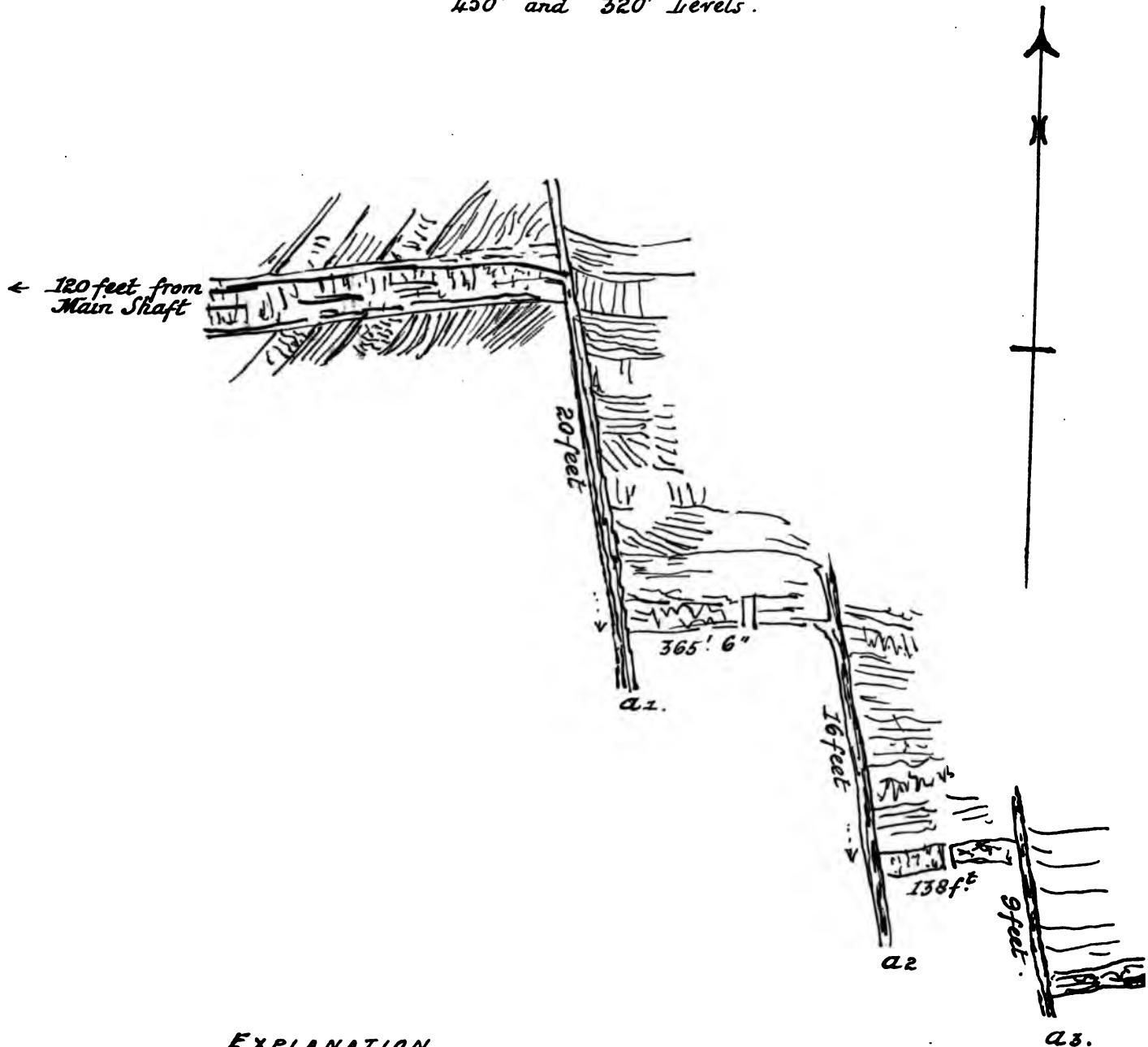


CROSS SECTION (Looking West,



LEFROY GOLD FIELD.
New Native Youth Co: Mine.

Showing Iode faulted, and contortions of Strata.
450' and 320' Levels.



EXPLANATION

a1 First fault displacing or throwing Iode 20 feet
a2 Second do do 16 feet
a3 Third do do 9 feet.

G. Thureau, F.G.S.
1882.

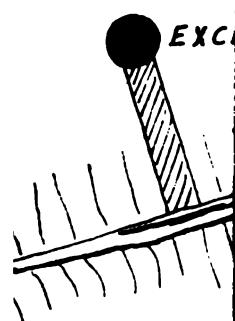
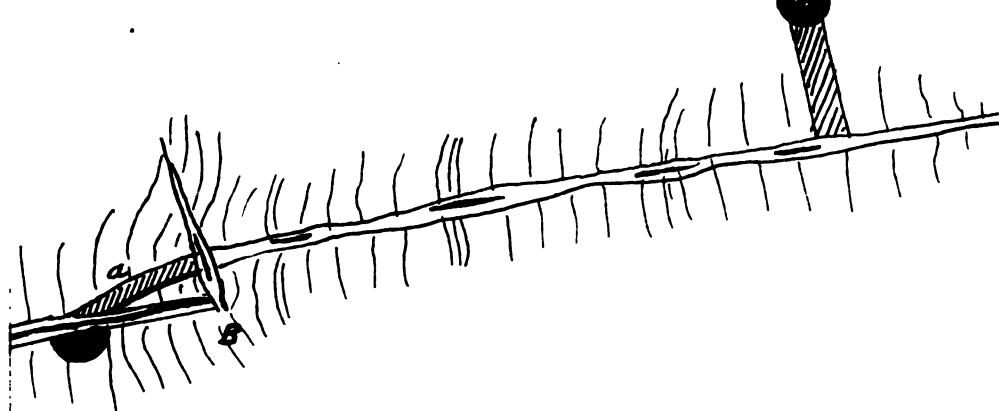
JOY GOLD FIELD

PLAN C

EXPLANATION.

as rich Quartz Reefs thus —————
Isode ----- thus ————— F
is Winses thus 
B Cross Courses.
Dip of Auriferous Quartz in strike.

NEW NATIVE  YOUTH.



SKETCH PLAN A. F. OF THE
TH COMPANYS MINE. 320 FEET LEVEL.
Cross Courses, and faults.

G. THUREAU Feb. 1882.

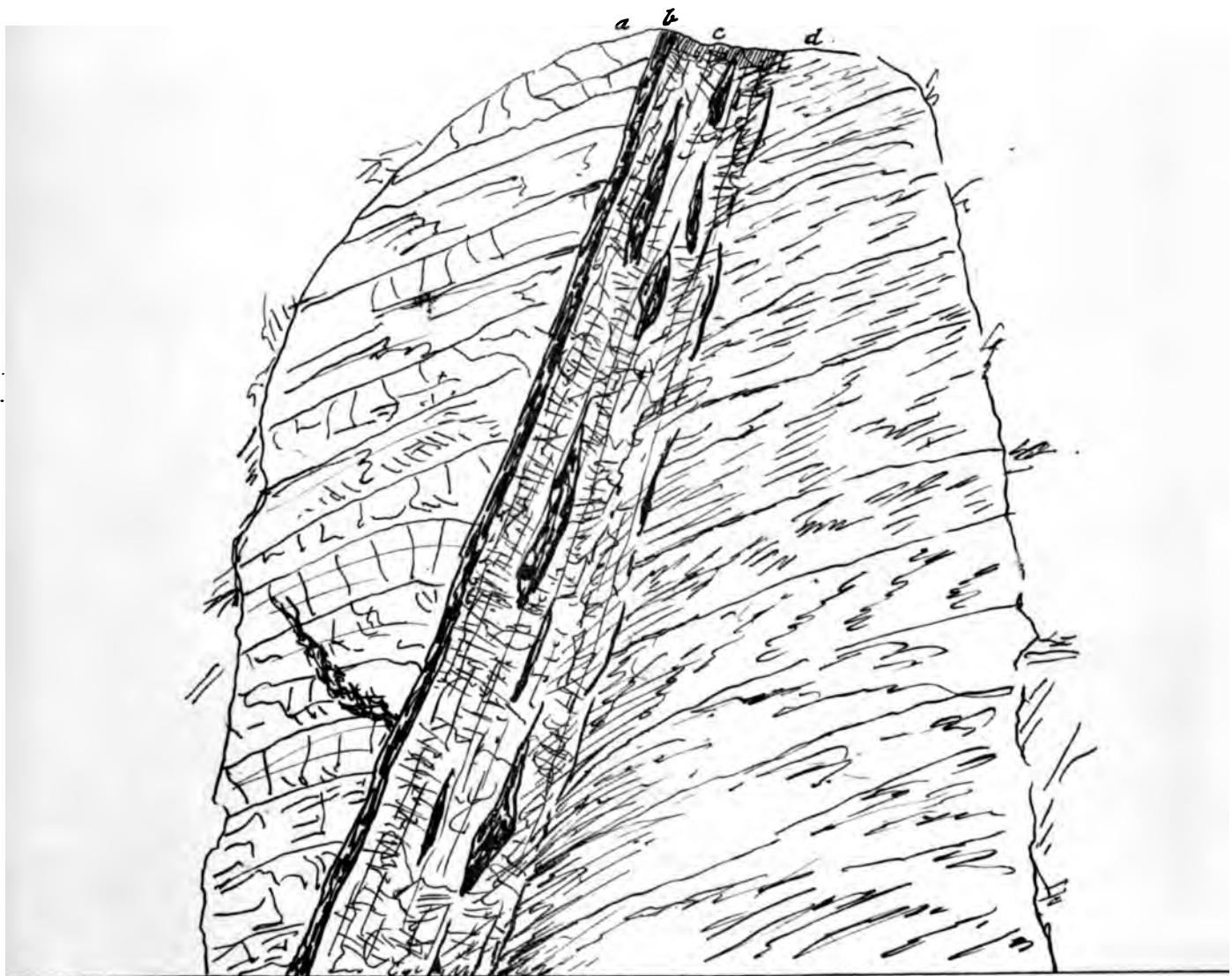
Land.

LEFROY GOLD FIELD.

New Native Youth Companys Mine.

PLAN 6

Sketch - CROSS SECTION at end of 200feet Level.



EXPLANATION.

1. Hanging Wall.

2. Selvage 'Flucan' composed of black decomposed Slate interspersed with Iron Pyrites

3. Quartz Iode (aav) in which flakes of Slate and Sandstone occur.

4. Footwall.

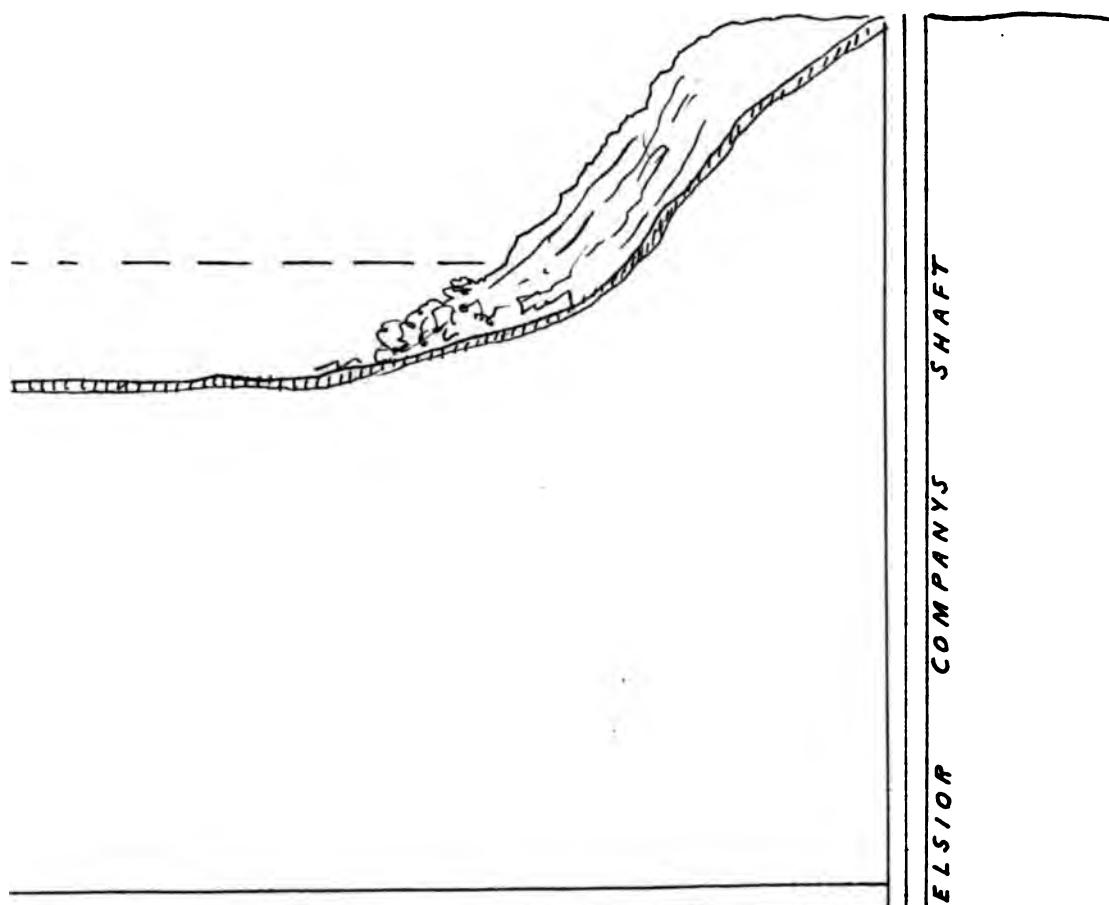
5. Fragmentary Flakes of slate and Sandstone derived from Wall rocks.

6a. This Quartz gradually disappears in the footwall, d, which latter is indicated by no actual and visible division.

G. THUREAU F.G.S.

1882.

II



1083



REPORT on the recently discovered Gold Field at Mount Victoria, County of Dorset, Tasmania, by G. THUREAU, F.G.S.

THIS goldfield is situated on the western flanks of Mount Victoria, or about half-way down from the summit of that mountain to the banks of the Dorset River. The country is thickly timbered, and a good thickness of soil of good quality is in places covering the rocks, causing a dense and luxuriant undergrowth of timber.

Mount Victoria (3964 ft. above sea level), with its serrated and columnar crests, is capped by a densely-grained basalt, which rests on horizontal beds of conglomerates, sandstones, and grits of coarse grain. These are succeeded by grey coarse sandstones, nearly vertical in position, and they are traversed by numerous and irregular bands and veins of non-metalliferous white quartz. These gradually pass into more crystalline schists of a metamorphic character, as seen in the deep ravines eroded in these ranges; and it is in this belt of metamorphic schists, which in the north merge into more clearly defined silurian slates and sandstones, that the principal auriferous deposits have been discovered by the prospector, Mr. R. J. Wilson.

The occurrence of gold in this part of the district is, so far, confined exclusively to the *veins* of gold-bearing quartz opened in several places, and no attempt has hitherto been made to test the alluvial gravel deposits in the creeks or in the Dorset River for gold, which probably will yet be found in them.

The geological formation enclosing these auriferous vein deposits presents some very peculiar features worthy of attention, because to a great extent this occurrence of gold-bearing quartz appears to be regulated by the positions observed by the surrounding strata. The metamorphic beds in question are subject to considerable foliation and contortion, by means of which the gold-bearing matrices are made to assume varying angles of inclination to the horizon, rendering it somewhat difficult for the observer to distinguish whether some of these vein-stones, so very similar in character, are, or are not, parts or portions of the same line of reef. For instance, the channel of the present Wilson's Creek, in its westerly course, passes through the apex belonging to the principal anticlinal foliation in that locality, so that, whilst on one side of that creek the schists dip to the north-west, that inclination is reversed on the opposite side to the north-east, the apex observing meanwhile an easterly course.

On the south side of the same creek it was observed that the outcrops of the gold-bearing quartz veins obtained the greater extension in their strike; and one of these veins has been traced for nearly seven chains in length, and wherever same was tested the presence of fine gold has been proved by crushing small quantities or samples taken at random in the mortar.

In nearly all the various workings examined the gold-bearing stone partakes of the same character, viz.—great density, weight, and hardness. It is nearly always of a laminated description, and charged with arsenical pyrites and the allied "pharmacociderite," which latter gives a peculiar greenish hue or stain to most of these veinstones; galenites, iron pyrites, and calcites are also found, presenting altogether the same appearances so characteristic of other auriferous quartz reefs.

The gold is rather light in colour, denoting an admixture with silver, and it is, generally speaking, more of a fine than even moderately coarse description, which will necessitate the use of the very best appliances in crushing and amalgamation in order to collect this fine gold, which, if treated in the ordinary way only, will entail a considerable loss of gold during the manipulations necessary in separating the gold from its matrices.*

* A small sample of stone, weighing but 2 ozs. troy, gave after crushing a yield of 21 grains of gold; it is not known, however, whether this was a parcel selected for showing good gold.

The Reefs.—I am of opinion, after careful examinations, that some of these quartz veins can be wrought at a profit, if proper attention is bestowed on the treatment of the stone that is being raised at the present time. At the same time it is quite possible that some of the outcrops on the surface now distinctly separate will be found to belong to certain lines of reef, whereby the number of the former will be reduced. So far as my examinations have extended, the belt of metamorphic schists as traversed by the auriferous quartz veins is from seven to eight chains in width, and gold-bearing quartz has been discovered in the outcrops for a distance along their strike of from three to four miles, i.e., three miles north and about a mile south of the prospectors' camp. It is quite possible for other gold-bearing veins to exist within or even outside of those limits, but the depth of the surface soil and the prolific vegetation prevents their discovery at present.

South of Wilson's Creek, the underlay of these auriferous veins—they cannot in the absence of more extensive and deeper mining operations which would disclose their permanent character or otherwise, be called "lodes"—is principally to the east, at angles ranging from 70° to 82° , thus dipping, as it were, beneath the non-auriferous strata overlying them higher up the ranges descending from Mount Victoria.

North of the same creek the underlay of the veins discovered varies considerably, the angles approaching more the vertical. "Faults" are also more prevalent in that direction owing to the greater disturbance occasioned by the tilting of their country rocks.

The first vein discovered by the prospector of this new district exhibits a laminated quartz, stained green from decomposed arsenical pyrites, and is embedded in "altered" slates and sandstones; the vein has a bearing of south 53° east, and it is from 6 inches to 1 foot in width. The stone becomes more mineralised and richer in depth. This vein reappears at the surface across Wilson's Creek in several places, and it maintains a good appearance, with great regularity of its gold-bearing qualities, wherever it has been traced by means of surface trenches, &c. Above it, on the ranges, in a south-easterly direction (here rising fully 45° to the horizon), six successive outcrops of promising auriferous veins have been found, ranging from a few inches to two feet in thickness; of these, three or four have yielded very encouraging prospects on the quartz being crushed in my presence by hand, and they evidently would supply, if systematically opened up by means of adits, for which this region is so eminently adapted, a very considerable quantity of gold-bearing quartz for crushing in batteries when such shall have been erected.

The more dense and laminated veinstones are, in this locality, generally accompanied by other quartziferous strata in the walls, also auriferous in places, which probably, at a greater depth, will cause an increase of the width of the veins in question.

On the prospectors' area, north of Wilson's Creek, four promising gold-bearing quartz veins have, so far, been discovered; and it is quite possible, judging from the surrounding circumstances, that they may prove the continuations of the veins occurring on the south side of that creek or watercourse, or also on the opposite side of the foliations described, or that anticlinal axis.

North-west of the prospectors' camp, at a distance of about a quarter of mile, is the Mercury Association's ground. Their No. 1. vein has been bared of the surface soil and talus; it is from two to three feet wide, and is composed of a solid gold-bearing quartz in a nearly vertical position. Farther along, in about the same direction, No. 2 vein was also closely examined, and this proved the more valuable of all on this goldfield. The vein observes a bearing of North 60° West for a width of 18 inches, and to the south a fault has caused the stone which underlies west to be thrown thirty feet before the continuation could be found again. If for nothing else, this disturbance has by some means enriched the quartz considerably for a width of from 20 to 24 inches. South of the fault the stone also underlays in the reverse direction, making it appear as if a junction would occur at some depth, which however appears somewhat doubtful, as has been found frequently in other cases it would not do. This is the most massive vein formation yet found on Mount Victoria, and in which fine to coarsish gold is showing more freely than any of the other veins. Some very rich stones were broken during my examinations from the bottom of a cutting about 23 feet deep; and in the stone raised from the adjoining shaft, 26 feet in depth, gold was exhibited in a narrower stone more pyritous in character. The wall-rocks in which this rich vein occurs are of a clearer slatey and sandstone character, almost vertical in position, and this stone is one of great promise if it continues to greater depth than at present.

About two miles and a quarter north from the prospectors' camp, following a partly-formed steep sidling track, the Mount Victoria Prospecting Company are also opening a large vein of quartz, on which they have sunk about seventeen feet; the vein, which is of good width (2 feet) has a bearing of North 8° West, and it underlays at an angle of 53° to the West. The hanging wall is very regularly formed, and a soft selvage marks the course of the vein. This appears to be a large vein of gold-bearing quartz formed of blocks dipping north; there is no regular footwall in the east, but a formation of brittle and auriferous quartz, interspersed by blue slate, joins the harder quartz west, and thus forms a very promising deposit, which can be worked very advantageously by means of adits driven in the range nearest the Dorset River, which pursues its course about 350 feet below this outcrop, and at a distance of about 30 chains west.

Gold is reported to have been found in quartz at a distance of a mile farther north, or close to the track cut some years ago from Ringarooma to Black Boy.

The existence of quite a number of gold-bearing quartz veins at Mount Victoria having been proved at and near the surface by means of the numerous workings made by various parties in a belt of country of considerable extent, the question of their permanency in strike or depth can only, on account of the limited depths yet reached, be a matter of opinion, or rather of comparison with similar deposits elsewhere, where the surface extensions along their strike stand in direct relation to the depths they may be followed with remunerative results.

The water power available for crushing purposes ultimately necessary for the development of this new goldfield is found chiefly in the Dorset River, where over twelve sluice-heads may be counted upon, not taking into consideration that which may be obtained from the Ferny, Wilson's, and Lucky Creeks, which are never dry it is reported. This would suffice for some time to come, and the supply now available can easily be augmented by the construction of capacious storage reservoirs.

There is also a considerable quantity of suitable mining timber close at hand.

The abrupt flanks of Mount Victoria, in which these veins occur, present great facilities for working and testing these deposits at greater depths, by means of low-level adits, in a more economical way than by means of shafts sunk from the surface, which latter require close timbering, and constant windlass work for some time to come. And as the future prosperity of this new goldfield depends greatly on thorough reliable tests of the stone raised, (about 40 tons raised now), a small five-head battery worked by means of an inexpensive "reaction jet water-wheel," so universally and successfully employed in the mining districts of the Pacific Slopes, U.S.A., would, as a preliminary, prove whether the results achieved thereby rendered the erection of more expensive and powerful machinery necessary.

G. THUREAU, F.G.S., *Geological Surveyor.*



**REPORT ON THE NEW TOWN COAL
DEPOSITS.**

BY F. W. KRAUSE, F.G.S.



Office of Mines, Hobart, 31st December, 1883.

SIR,

IN compliance with your verbal instructions of the 20th instant, to examine into the character of the New Town Coal deposits as a field for the advantageous employment of the diamond drill, I have the honor to state that I have made a geological examination of about sixteen square miles of country around New Town, and I beg to enclose herewith my Report thereon, with plan and section.

I have the honor to be,

Sir,

Your obedient Servant,

F. W. KRAUSE.

The Hon. N. J. BROWN, Minister of Lands, &c., Hobart.

GEOLOGICAL SURVEYOR'S Report on the New Town Carbonaceous Deposits.

My instructions to advise the Hon. the Minister of Lands on the expediency or otherwise of employing the diamond drill in search of workable coal seams at New Town, necessarily conditioned the examination of a somewhat more extended area than that occupied by the so-called New Town coal basin, the very limits of which could not, indeed, be determined without proper enquiry into the disposition of the bordering rocks. The result of this enquiry is laid down on the accompanying geological plan and section and the descriptive notes there inserted. I may therefore in this place confine myself to state the practical outcome of the enquiry.

At the outset, it should be stated that so far no seam of true coal has been discovered at New Town. The material raised and sold as such is a carbonaceous shale. The better sample is finely laminar, and some of its laminae, often less than $\frac{1}{100}$ part of an inch in thickness, are made up of a non-bituminous coal (anthracite and mineral charcoal), the amount of which, however, rarely exceeds 5 per cent. of the bulk of the material.*

For the purpose of this enquiry it is sufficient to speak of the shales, sandstones, and intercalated carbon beds as "coal measures," without implying a relationship with the carboniferous beds of Europe. On the contrary, the pecopteris and zamites shales, as well as the lithological character of the whole of the upper beds, bear a marked resemblance to the oolitic coal-bearing rocks of Western Port and Cape Otway in Victoria, while the lower fenestella beds are of upper palaeozoic (permian?) type.

The thickness of these upper coal measures does not exceed 435 feet, and the area occupied by them is somewhat under three-quarters of a square mile (420 acres). There are six "coal" seams known to exist, having an aggregate thickness of 11 feet 8 inches. The greater number of these seams extends over portion of the field only. Assuming that no faulting or thinning out interfere with the observed dimensions, the total quantity of "coal" at New Town, including what has been already raised, will amount to about 3,800,000 cube yards, equal to about 4,000,000 tons of coal shale. This is the utmost capacity of the field, and there is no prospect whatever of true coal (either anthracite or bituminous) being found at a reasonable depth.

* The term *anthracite* for the New Town fuel is quite inappropriate. Anthracite implies the existence of *coal* which at a later stage was deprived of its bitumen. But in this case the material originally deposited was not a coal, but a bituminous shale which plutonic action deprived of its hydro-carbons and converted into *carbon-shale*.

A shaft on the Government farm would strike Parson's seam at a shallow depth; beyond that depth no workable seam will be met with, unless it be the faulted portion of Dr. Benjafield's seam, which is, however, problematical. The whole field is so well laid open by natural and artificial sections that a bore sunk on the basset of the highest beds,—say the upper adit near the south-east corner of the Orphan Asylum reserve,—might be sunk to a depth of 2380 feet without disclosing features other than what can be "read" on the surface and in existing pits. Supposing all the members of the series to be represented, the following would be a section of the rocks bored through:—

| | | Depth of Strata. | Depth of Bore. |
|-----------------------------|--|---------------------|-------------------|
| UPPER COAL MEASURES. | Carbonaceous shale (crops out at upper adit on Bedford's land, No. 1 seam)..... | 1 0 | 1 0 |
| | Shale and sandstone | 21 0 | 22 0 |
| | Coal shale (No. 2 seam), struck in adit near S.E. corner of the Orphan Asylum Reserve | 1 6 | 23 6 |
| | Clay shale and sandstone..... | 78 0 | 101 6 |
| | Carbon shale ("Rosetta," or No. 3 seam) | 3 0 | 104 6 |
| | Clay shale | 1 9 | 106 3 |
| | Sandstone, with nodules of pyrite, and fern impressions | 98 0 | 204 3 |
| | Carbon shale (part of No. 4 seam) | 1 6 | 205 9 |
| | Clay shale replete with pecopteris (two species), zamites, &c..... | 1 3 | 207 0 |
| | Carbon shale (part of No. 4 seam)..... | 1 0 | 208 0 |
| GREY AND YELLOW POST. | Shale and sandstone | 215 0 | 423 0 |
| | Carbon shale (worked in Parson's shaft) | 1 10 | 424 10 |
| | Blue and grey shale and sandstone..... | 10 2 | 435 0 |
| CLAY ROCK. | False-bedded sandstone with fern impressions; also thin shale layers | 850 0 | 1285 0 |
| | Sandstone, exposed in shaft and bore at Upper Park-street. | 155 0 | 1440 0 |
| | Sandstone, largely quarried for building, with occasional false bedding and ripple marks. A few fern impressions. | 350 0 | 1790 0 |
| FOSSILIFEROUS LIMESTONE. | Light grey indurated clay shale | 300 0 | 2090 0 |
| | Breccia and conglomerate of fragments of quartz, quartzite, granite, and slate in a claystone base | 10 0 | 2100 0 |
| | Sandy limestone and calcareous shales and sandstones, containing an abundance of marine shells and coralloids (spirifer, three species, productus, fragments and casts of univalves, and numerous fenestellidæ.) The beds become nearly horizontal with increasing depth | 280 0 | 2380 0 |

I have already stated that no coal of reasonably good quality need be expected in the upper coal measures. Similarly the grey and yellow post, the clay rock, and the fossiliferous limestone have all proved barren of coal and coal shale, and it therefore remains but to explore the rocks which lie beneath the latter. I have been unable to find an exposed section to aid the enquiry beyond a certain point, as the lower beds abut everywhere against the diabase. It is here, then, that the drill must be resorted to, and the only prospect of meeting with workable coal deposits is by boring below the lowest outcropping fenestella beds.

I recommend as such a site the upper part of the western branch of M'Robie's Gully, or a corresponding position in Guy Fawkes Rivulet; and I am of opinion that this mode of exploitation besides being of the highest scientific interest, must practically decide the question whether or not this and other parts of the Island of similar physical and geological structure are destined to become economically important coal fields.

F. M. KRA

Office of Mines, Hobart, 31st December, 1883.



Geological Sketch Map Country around NEW TOWN

Scale, 6 inches to the mile

F. M. Krause
F.G.S. London
OFFICE OF MINES, HOBART
December 31st 1883

REFERENCE

3

MIDDLE PLIOGENE
(OR OLDER)

Clays, limestone with land
and freshwater shell, etc.



DIABASE
OF VOLCANIC ASPECT

concretionary
impeded rock is
limonite

with thin l.

in a few

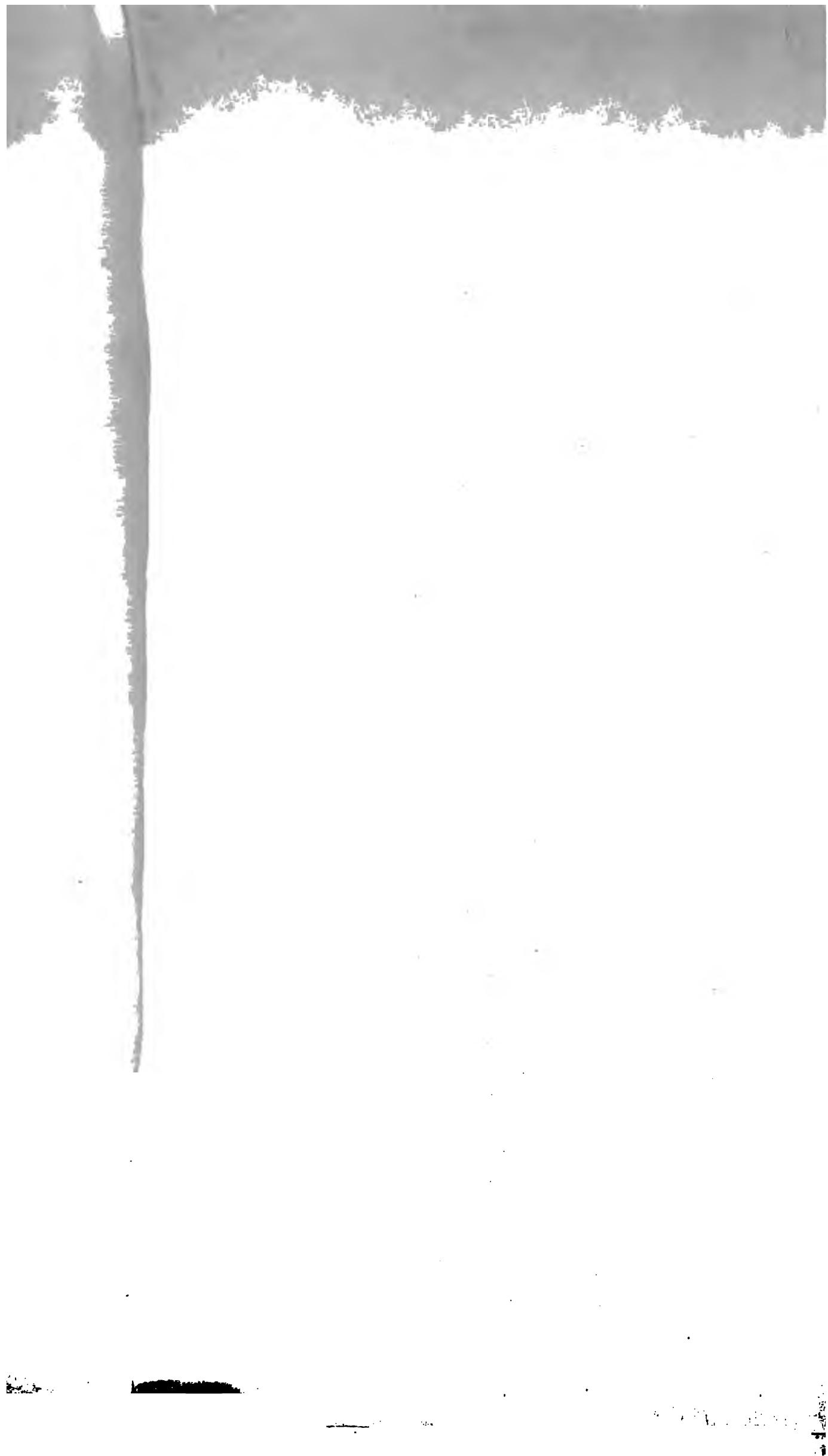
beds more

less.

anthracite. Large nodules of pyrite in sandstone

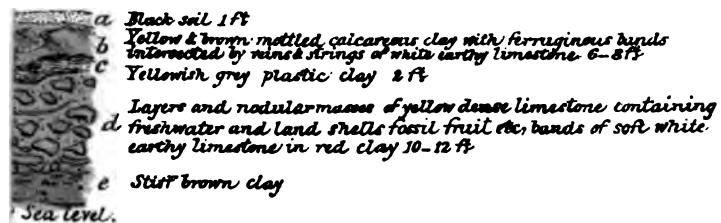
stone of subordinate extent.

fragments of univalves etc;



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I BAY LIMESTONE QUARRY
(EAST)

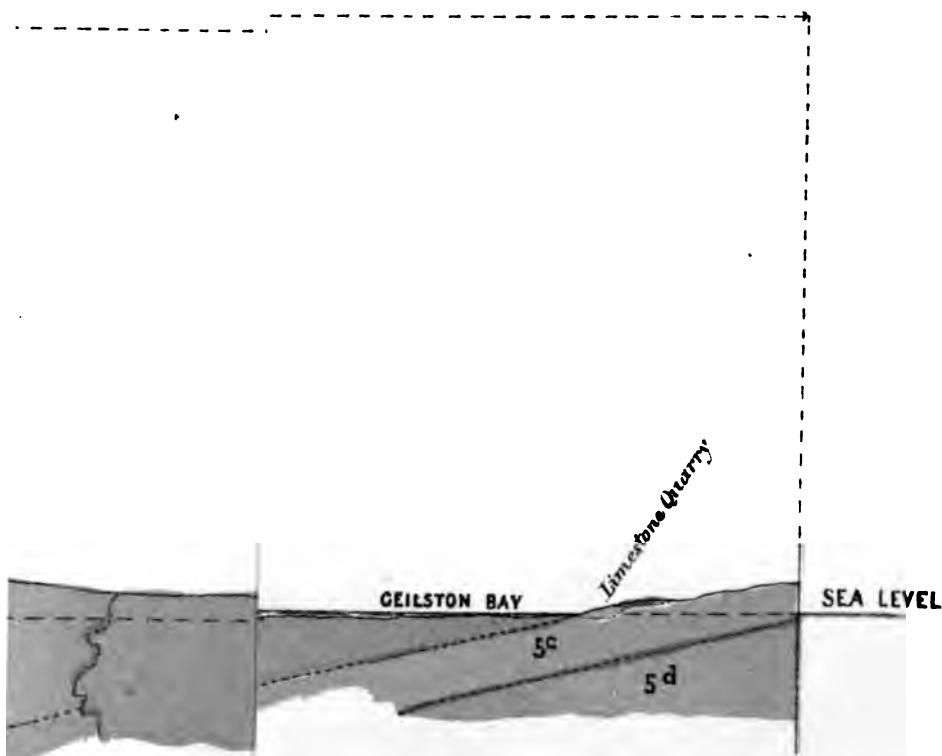


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F.M. Krause
F.G.S. London

OFFICE OF MINES HOBART 31.12.83

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(No. 104.)



1884.

PARLIAMENT OF TASMANIA.

MOUNT CLEVELAND AND CORINNA
GOLD FIELDS:

REPORTS BY MR. G. THUREAU, F.G.S.

Presented to both Houses of Parliament by His Excellency's Command.

YANKEE
SCHOOL



REPORT on the Specimen Reef, near Mount Cleveland.

April, 1884.

THIS is situate west north-west of Waratah, at a distance of about thirty-two miles along the newly formed track. The geological features of the country observed on that line of communication consist of, near the Arthur River, metamorphic schists, here and there overlaid by basaltic sheets; at the Magnet range, those upper volcanic rocks rest upon a thick stratum of "lignite," probably, as in other similar places, covering a deep diluvial wash or "lead." On the open plains further on, the continuation of that sharp-angled quartz detritus, so peculiar to the Western mining districts, is found to be covered with a swampy and peaty soil, frequently several feet in thickness, and which prevails so greatly on Long and Brown's Plains and on the south side of the Pieman River to within a few miles of North Mount Heemskirk.

Several tributaries of the Savage River, near its head, were crossed in travelling, in which those characteristic Pliocene drifts and gravel beds, so frequently found in the Victorian and other gold fields, occurred *in situ*, capped in places by outliers of basalt. These creeks have yielded some gold, but as the scrub is so excessively dense and almost impossible to penetrate, the results of the prospectors' labours have up to the present time remained an unsolved problem to a very considerable extent, though it is well known that some of those workings have enabled these miners to become possessed of considerable amounts of coarse and very heavy gold every season since first attention was drawn to the Pieman or Corinna Gold Field. There cannot be any doubt but what my opinions as expressed in my Report No. 82, 1881, pages 5 and 6, under the head of "*Permanency*," regarding the extent of such auriferous deposits on the Long Plains and from there to the west north-west of Mount Cleveland, have been borne out by these later discoveries. It remains, however, to be observed that those discoveries are, as yet, partaking of the nature of *indications* for the existence of a much larger gold field as yet undisturbed, and scarcely impinged upon by the picks of the miners.

The vicinity of the Specimen Reef is very mountainous, and the "gulches" and "ravines" feeding the main creeks are most precipitous, and have a very rapid fall towards the Savage River. The formation is Silurian in part, but the metamorphic schists prevail largely, and they are very similar to those observed at Mount Victoria. Within three miles of the reef itself these metamorphic schists occur as contorted slates and sandstones, micaceous in parts, and they are traversed by irregular bands and interlacing veins of white, and infrequently blue veined, barren quartz.

As illustrated by the diagrams enclosed—the longitudinal section of Specimen Reef Creek (which empties into Hall's Creek)—that watercourse has a very steep descent, which did not permit any extensive or deep accumulation of recent (pleistocene) gravels. Gold-bearing quartz, and from time to time rich specimens, having been found in those circumscribed gravel beds by the prospectors, Messrs. Thunder and Greenaway, they were eventually rewarded by the discovery of the present Specimen Reef, which yielded, I am informed, about 40 ozs. of free gold from the specimens found at or close to its outcrop.

The Workings.—These disclose in the upper tunnel soft yellow sandstones and light bluish slates, stained by the peroxide of iron, as the country rock. Besides that, all water exuding from the reef, as it was followed in this adit, deposits considerable quantities of ochreous sediment, indicating a continuous decomposition of sulphurets by chemical and atmospherical reactions. That this decomposition had been in progress for very long periods in the past is proved by the occurrence of a coarse quartz detritus, forming a breccia of irregular and angular composition, held together by or cemented with brown iron ores ("limonites") overlying the outcrops or their vicinity on the reef. The upper tunnel passed, I am informed* about 30 feet beneath the spot in the creek in which the prospectors first met with the outcrop of the reef, and at that part of the workings it was said those

* It may be stated that during the whole of my examinations under the guidance of the Mining Manager, I did not see, or was shown, any gold; the only evidence of gold-bearing stone having been obtained was from specimens exhibited at Launceston, the office at Waratah, and the quartz presented to the Mining Museum here, and those submitted for assay.

rich specimens were found which were publicly exhibited, the total length of this adit being a little over 300 feet. In that distance the two shoots of gold measure 160 feet and 12 feet in length each, and they are separated by a narrow and very poor portion 40 feet along the course of the lode. The underlay of the reef is to the east, and the shoots of gold-bearing stone are dipping southerly at an angle of inclination less than 45 degrees, so that on this upper tunnel there remain 30 feet of backs to stope out.

The lower or main adit has been commenced further down the same creek, at such depth as to give about 109 feet of backs to the bottom of the upper adit, or 139 feet altogether. The lode formation was met with at 290 feet, and from there the reef has been followed along its course, the adjacent strata observing a bearing of N. 54 E. So far gold had not yet been seen in this tunnel, as, owing to the dip of the shoots of gold intersected above, a good distance would have yet to be driven for same, unless other shoots not yet discovered were found at that increased depth. The general appearance of the reef is very good, it being composed of a whitish coloured quartz, having at the same time a laminated appearance from the pyrites with which it is so heavily charged; it appears that the latter are highly auriferous, resulting after their decomposition in the production of a blackish friable powder, in which the gold occurs in filigree forms and also in very solid heavy lumps of, by all appearances, a very high quality. The strike of the lode averages north 38° east in the enclosing strata, which bears at the mouth of the adit nearly due north by south. The vein-stone is pretty compact, from a few inches to nearly three feet in width: the more attenuated parts being generally very poor, and the wider carrying the gold in shoots. Frequently the lode is very loose, and when undrained requires much care in working, as the vein-matter is then inclined to "run," filling up the adit to a considerable extent. The "caps," so to speak, or the vein-matter, on approaching the shoots of gold are generally indicated by the larger admixture of carbonates of iron ("siderites") with the vein-stone, which latter assumes thereupon quite a different appearance.

In the upper level or adit it may be mentioned the sulphurets have either disappeared altogether after decomposition, leaving a cellular and porous blackish quartz, in which the heavy gold sometimes predominates, or, in that vein-stone, strongly impregnates the whole of the reef at such places. At the lower adit, it may be observed,* the gold was seen as embedded or associated with solid sulphurets remaining, as having not suffered from any such decomposition.

The lode has been faulted to an inconsiderable extent once or twice; the "slides" at these interruptions of the more regular course of the lode are distinguishable by the occurrence of black and unctuous clay-veins with some gritty quartz cutting across the country rocks. Generally at this greater depth the lode formation was found to be very similar to other gold-bearing reefs; the hanging-wall was composed of a hard sandstone, whilst the foot-wall consisted of a somewhat softer metamorphic slate. Up to the time of my visit gold had not been observed in driving this lower level; there was, however, every indication for such to be met with shortly, and the reef was charged with an unusually large percentage of iron, and also some copper pyrites.

This reef, or auriferous quartz lode, which is so far the only one as yet discovered to date, forms a well defined and strongly developed metalliferous deposit of very considerable promise for its future permanency, and there appears, in my opinion, nothing wanting but suitable crushing and gold-saving machinery to render the working of it a profitable concern, if managed intelligently and worked persistently.

Water as a motive power is readily obtainable in the neighbourhood, and as the fall of the creeks is so great, the supply promises to be intermittent; the adoption of turbines (Leffel's), instead of the ordinary ponderous water-wheel appears as more preferable, because the former are so much more easily transported, and erected at less cost, and they produce with a given head and quantity of water a very considerable percentage of more motive power than any other water motor.

From the general features of the surrounding country, there appears every likelihood, if once the dense scrub is made more accessible for prospecting, of the existence of other reefs in that locality; and there is no doubt whatever, in my opinion, that the undeveloped belt of auriferous quartz having materially contributed to the enrichment of the alluvial (*pleistocene*) and diluvial (*pliocence*) gold deposits occurring on Long Plains, Bauera, Riley, and Smith's Creeks, Rocky River, Brown's Plains, and Middleton's Creek.

G. THUREAU, F.G.S.

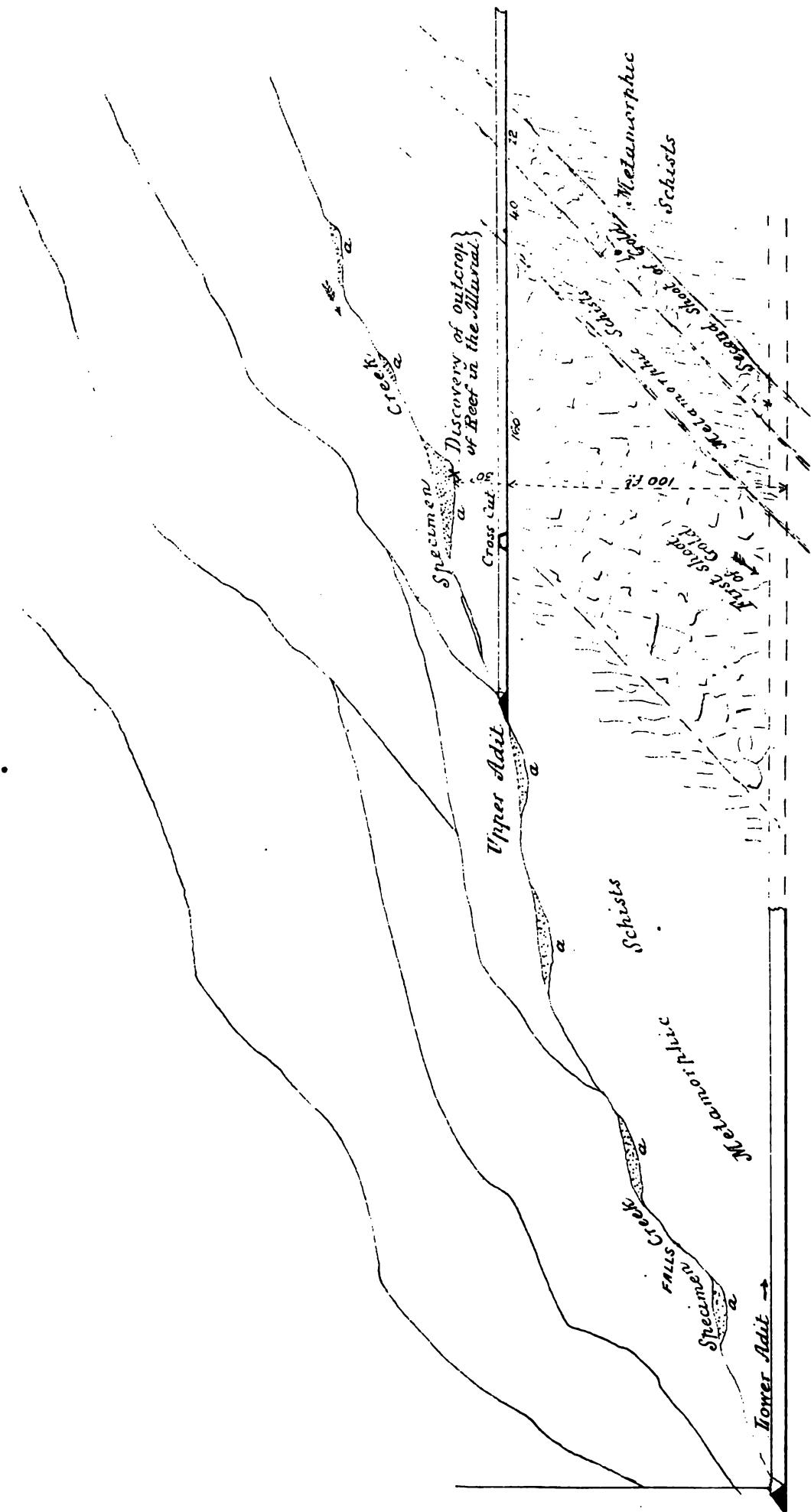
MEMO.—New Minerals discovered on this goldfield:—

"White Arragonite," in radiating acicular groups, in Serpentine, near Alford's Store, Pieman Track.

"Titaniferous Iron Ore" in granitoid (micaceous) rock near Pieman River.

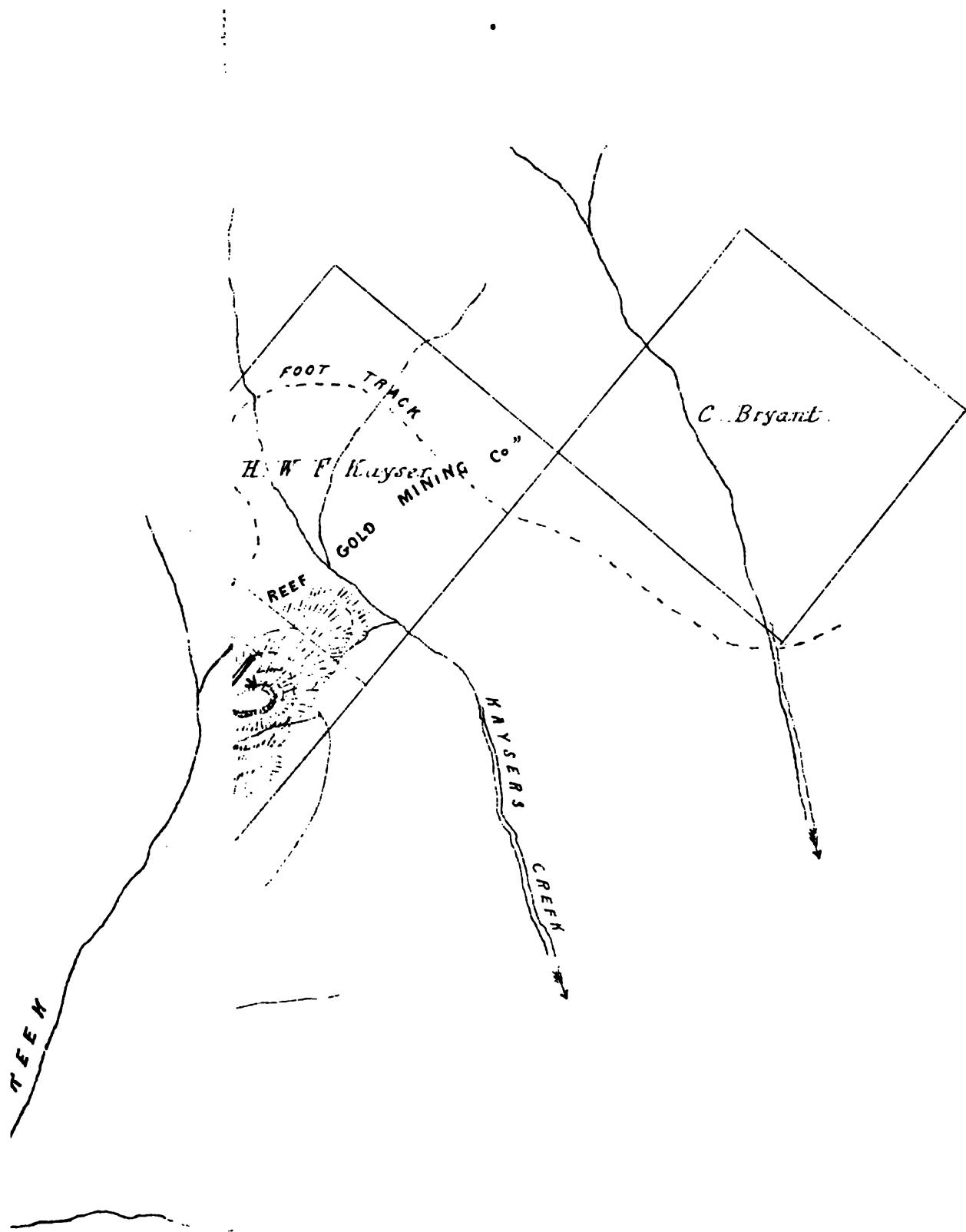
Asbestiform "Actinolite" of a light greenish colour, in quartz, from the head of the Whyte River, Long Plains.

* Since this Report was taken in hand, or after the survey of Specimen Reef, I was instructed to also visit the West Coast; in the mean time rich gold quartz had been found at the lower adit.



LONGITUDINAL SECTION OF SPECIMEN REEF. a. a. a. Alluvial deposits in the Creek.

Office of Mines



EXPLANATION

| | | |
|------------------------------|-------|-------|
| Upper Basalts | ----- | ----- |
| Auriferous Quartz Reefs | ----- | ----- |
| Detrilus | ----- | ----- |
| Metamorphic Schists | ----- | ----- |
| Lower Adit | ----- | ----- |
| Underlay of Reef | ----- | ↓ |
| Upper Adit on course of Reef | ----- | × |

Feet. G. Thureau F.G.S.

REPORT on the Corinna Gold Field.

June, 1884.

STARTING from the Pieman River, it was noticed that alluvial gold-mining had been carried on in several new localities since my first inspection of the field in 1881 ; also that certain other places, then favourably reported on as likely for the occurrence of gold deposits, had scarcely been touched at all. These remarks refer to what could be seen in the vicinity of the main track ; and the Rocky River, or those diggings at or near Smith's, Riley's, and Bauera Creeks could not, on account of the prevailing rough weather, be more closely or at all inspected. From the observations that were made it became, however, very apparent that wherever the older Pliocene gravels were exposed to view as resting upon the slate formations—Silurian and Metamorphic—gold had been found in more or less remunerative quantities. Considering the density of the scrub, and the fact that more recent gravels and hard conglomerates of great thickness overlie the auriferous drifts and strata in most places, great difficulties intervene with the development of the region. These difficulties those hardy and persevering prospectors are slowly overcoming, and gradually it becomes a fact that this region, including the Savage, Pieman, and the Whyte River watersheds, constitute an undeveloped gold field, on which many heavy finds of gold have been made, the actual value of which is not, so far, known, as for various reasons the miners have thought fit, as of more direct advantage to themselves, to withhold that most important information from the authorities and the public at large.

As the yields of gold from those several “*placers*” cannot possibly be gauged under these circumstances by the restricted returns made by the banks or other shippers of Tasmanian gold, and as the whole question of our yield of gold has a very important bearing upon the success and the permanency of our mining industry in several respects, I took occasion to embody my views upon the subject in a letter to the Honorable the Minister of Lands and Works, from Mount Heemskirk, on the 14th of June last ; several reliable returns of gold were given in same, and proposals submitted for consideration in order to obtain that so very desirable and reliable information, without any additional expenditure to the State ; that information thus obtained, if authoritatively published, would induce a larger number of miners and consumers to come here and give the goldfields that thorough trial which can alone be done by increased numbers of miners, prospectors, &c., as has been the experience in other gold mining countries where, by an augmenting digging population, the originally limited gold deposits were traced to large, permanent, and rich goldfields. From my own observation, and from what information I gathered from various sources, it is to be regretted that this Colony does not by some means or other obtain or derive those benefits which undoubtedly proceed from an increased mining population, for the convenience of whom the authorities have expended such large sums of money in cutting tracks, of building bridges, and otherwise very considerably improving the means of communication for supplying the miners with necessities.

G. THUREAU, F.G.S.

(No. 89.)



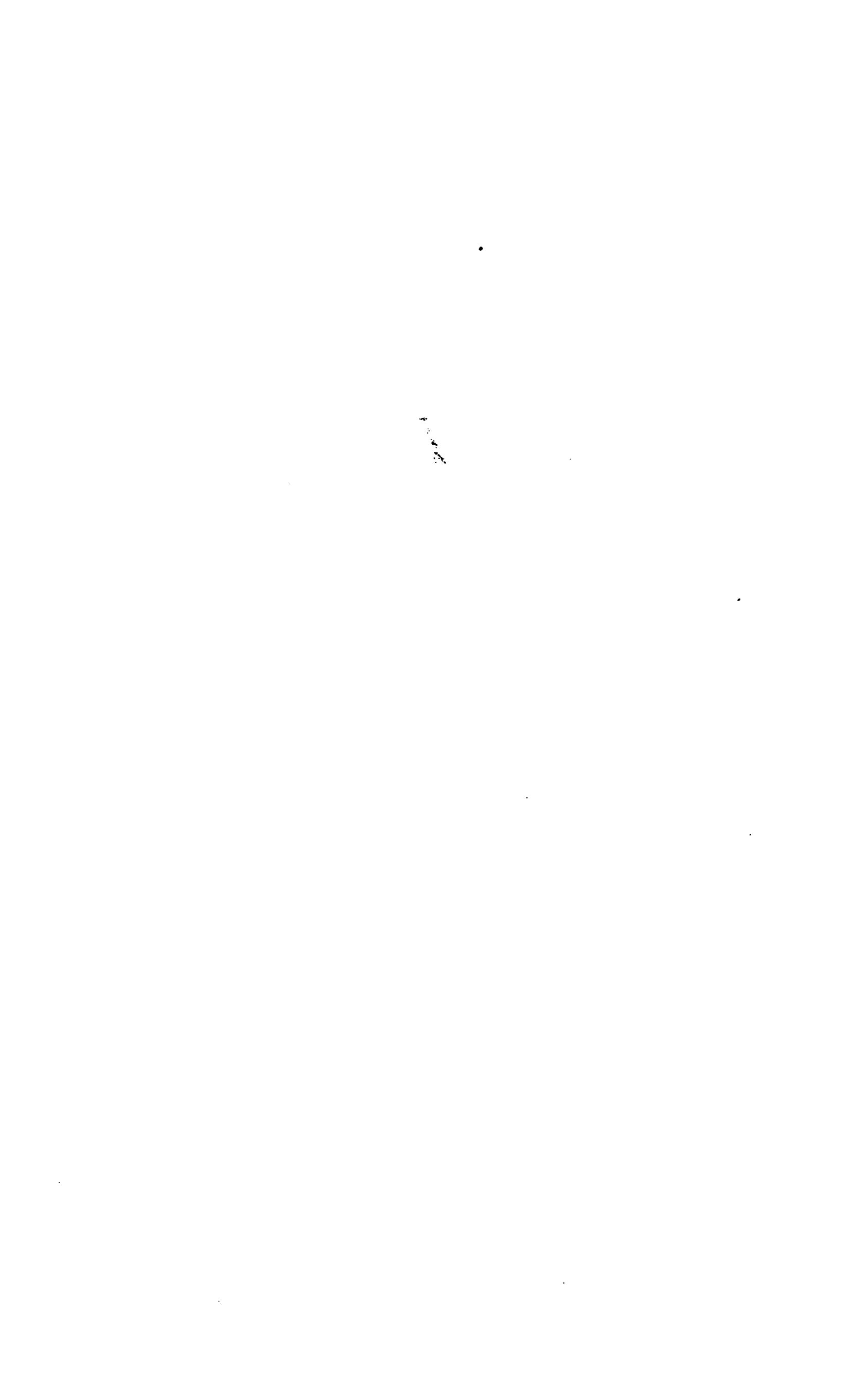
1884.

PARLIAMENT OF TASMANIA.

WESTERN MINING DISTRICTS :

REPORT BY MR. G. THUREAU, F.G.S.

Presented to both Houses of Parliament by His Excellency's Command.





REPORT on the present Condition of the Western Mining Districts, with special reference to their Mineral and Metalliferous Deposits; the Geological features observed, and other matters of interest.

Launceston, June, 1884.

My instructions included the examination and survey of the King River Goldfield, the Silver-Lead lode at Mount Zeehan, the country lying between Macquarie Harbour—inclusive of the Tin Mines at Mount Heemskirk—and the Pieman River, as well as the Corinna Goldfield extending towards Mount Bischoff.

The King River Goldfield could not be visited on this occasion on account of the track from Long Bay to Lynch's Camp being all but impassable, and for the want of horses, the police having prohibited further packing, as the horses were for a time incapacitated through having sore backs, &c. Consequently the only reliable information, obtained at Long Bay from storekeepers, miners, and the police, was communicated by letter to the Honorable Minister of Lands and Works on the 7th of May, from the Montagu Post Office.

The Silver-Lead Lode near Mount Zeehan likewise could not be examined on account of the bad state of the track at this advanced period of the year.

From the information obtained from various sources it appears, however, as very necessary that the whole district should be thoroughly examined in the coming more favourable season.

The Mount Heemskirk Tin Mining District.

Since my last official inspection in June, 1882, the development of these tin deposits has not, except in a very few instances, been carried on with great vigour, and in consequence the district still remains in an unexploited state, for without working the mines the deposits will never be proved to satisfaction. True, some proprietaries have extended their underground operations in a praiseworthy manner, but, as their neighbours have done but very little work, the isolated efforts of the former has left the question whether vein-mining will be remunerative and profitable much in the same state as it has been. It is, however, satisfactory to observe, that some companies having continued their operations below the surface, obtained proofs of not only their surface out-crops continuing in depth, but also that the ores occurred in other places along the course of the veins and lodes. With the exception of the Cumberland, West Cumberland, Champion, and Peripatetic Companies, no underground work of any magnitude was being carried on at the time of my inspection, and consequently most of the leases were *quasi* abandoned. In those mines where some work had been done since my last visit, I had to receive my information from persons left in charge as caretakers for what it is worth. Not less than four proprietaries were found to have erected complete crushing and concentrating machinery; three other similar plants were near completion, and one company had constructed a powerful steam winding and pumping plant, all the former employing exclusively water as their motive power, with the exception of the Orient Company, who work their battery also by steam power. It will thus be seen that a very considerable, if not excessive, amount of subscribed capital has been expended on mining machinery and general charges, and I think that a portion of such expenditure might very properly have been saved, as in some cases such was incurred where a limited number of days' crushing would totally exhaust the supply of ore made available by means of levels and their connecting winzes. To have proved the extent of the ore deposits along their strike in width and depth so as to have open a very considerable height of "backs," and to continue the openings of more of such ground in advance of the stopes should have been the primary consideration, and then, when these were satisfactory for continuously supplying a given machinery power, steps should have been taken to erect suitable plants accordingly. As is now the case, trial crushings have been made of ores that had been raised previously in limited quantities, and there-

fore insufficient for keeping the reduction plant regularly employed, thereby creating dissatisfaction, in other instances not the slightest consideration had been shown in regard to whether the veins or lodes were embedded in soft or hard country, or the lodes themselves were of a soft or hard description. With the former description of vein-matter it was imperatively necessary to provide a very large extent of well secured ground properly opened up by levels and winzes in order to keep up the supplies for the reduction plant; and in hard lodes especially, the mode of level driving and stoping, &c. would have to be accelerated by the use of rock-drills, driven either by compressed air or water under great pressure.

Until the various Companies have opened their mines to a very much greater extent than what they have done, in order to enable them to *blend* their poorer with their richer ores, and thus average the same, I regard it merely as misleading to record from any part of a mine or mines what the per-centa^{ge} per ton of vein-matter may be, because without any such averages being obtained for the purpose from *all* parts of the mine or mines, the hand or even battery tests of limited quantities cannot possibly be held as establishing the intrinsic value of that or the whole of such mines. The very peculiar way in which tests "on the shovel" are made do not give *reliable* results, because actually the results accruing thereby exhibit the contents of frequently three times the quantity of ore so manipulated.

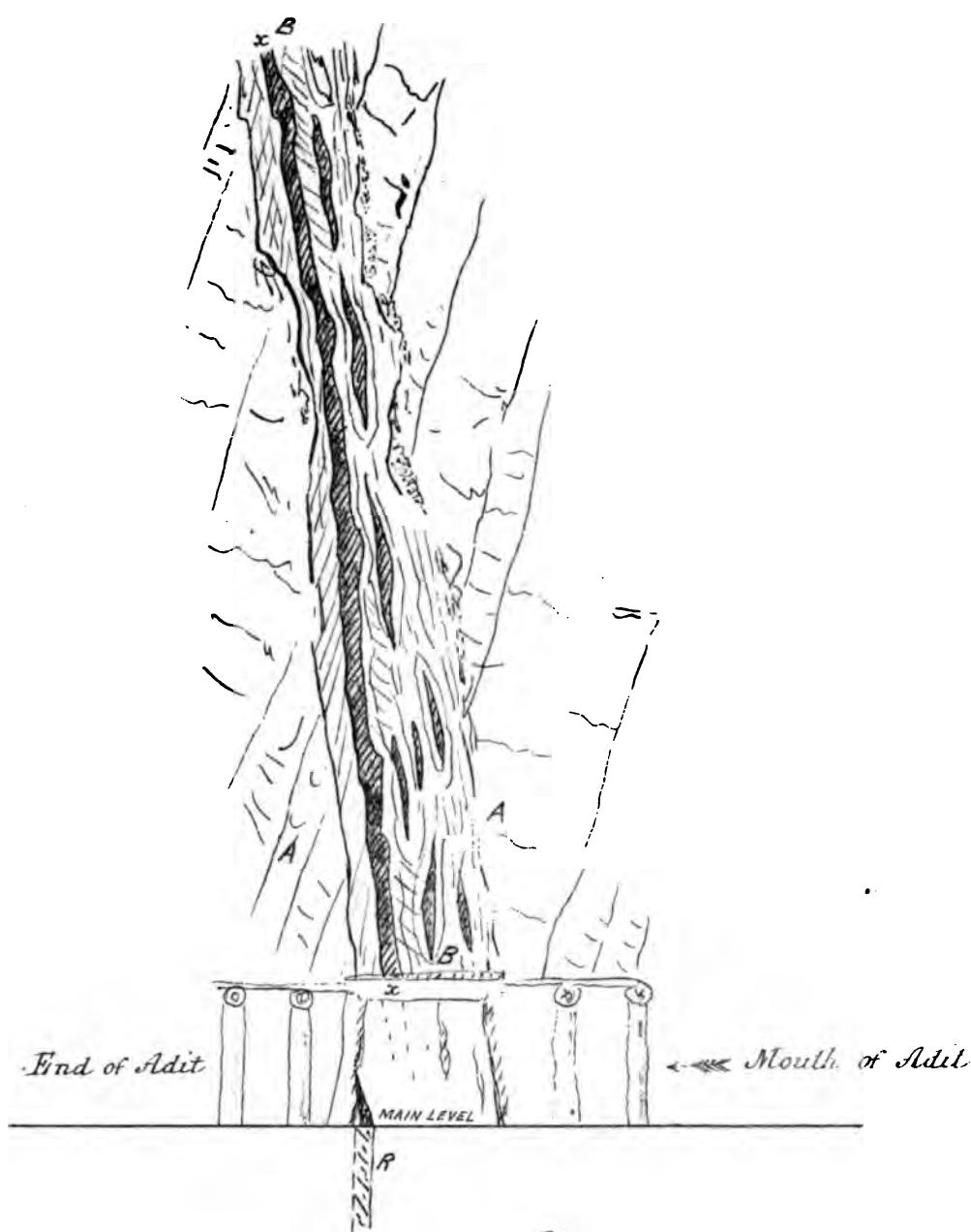
Vein tin-mining is no doubt very different from that of auriferous quartz reefs, where, after simply crushing, amalgamating, and the treatment of pyrites, the resulting gold, after retorting, has at once an economic value; it is also at variance with the manipulation of that immense deposit at the "Red Face" at Mt. Bischoff, which latter furnishes such almost unlimited supplies of ore, which, after a somewhat more intricate process, produces at per ton a uniform per-centa^{ge} of metallic tin. The Heemskirk Mines are no exception to the old and recognised rule in mining geology,—viz, "That almost every mineral or metalliferous district present features, though similar on the whole, differ in themselves from each other even with the same kind or description of ore." This necessitates a modification of working and treatment almost at nearly every other mine, in order to facilitate the winning of cleansed ore by the processes or machines employed for that special purpose.

Geological Features.

With regard to these veins or lodes, and their exploitation, at Heemskirk, it would appear as if too strict an attention to an experience gained in working in deep tin mines in Europe, or also the theoretical guidance from text-books on the subject, had resulted in the carrying out of works that otherwise would not have been undertaken had the features of the local lodes been more closely studied. This view is borne out in one or two cases; for instance, it is a recorded fact that the Great Flat Lode, south of Redruth and Cranbourne, in the Duchy of Cornwall, occurs between the metamorphic clay-slates (killas) and the primary granite, and the tin ore is associated with "schörl," i.e., tourmaline. That lode has been wrought to over 140 fathoms in depth, and in some places to a width of from 40 to 50 feet; there is but one wall at the joint of the two rocks, and in the "killas" but very rarely deposits of tin ore have been found to occur. In the granite, however, the ore forms a band of altered rock which gradually disappears in same from the vicinity of the wall or joint. The name of "eurite," a species of porphyry, has been but lately adopted in connection with our tin lodes, but from the description given by Dr. C. Le Neve Foster, in 1878, it is clearly demonstrated that those euritic dykes occur as associated with tin lodes in Cornwall as they do in Tasmania, and that their compact "schorl rock" appears as favourable to the ores as our tourmaline does here; but at Heemskirk these tourmalines are frequently altered into chlorites and steatites. In comparison with the above there appears one instance that has come under my notice where too much attention was directed to the probable discovery—if possible, as in Cornwall, the continuation of tin deposits, veins, or lodes—*cropping out in the granite*, in the adjoining and, in some parts, overlying metamorphic clay-slate or killas, whereby a considerable amount of the working capital appears to have been dissipated without any corresponding favourable results. As it was, the original rich outcrops of ore occurring in the euritic porphyry dykes enclosed in the granite were not nearly so exhaustively tested as the richness of them warranted in those rocks, but, instead, numerous underground prospecting workings, carried out apparently for the purpose of ascertaining whether or not those and other deposits would continue from the granite into and traverse the clay-slates. This error of judgment involved, after the completion of a good crushing and concentration plant, sinking of shafts, driving of crosscuts from levels, &c., the cessation of all operations, owing partly to the unremunerative per-centa^{ge} of tin in the ores raised, and the inability to raise sufficient quantities for manipulation. No doubt this failure produced, at a critical time, a prejudicial impression upon the owners of the surrounding leaseholds and the public also.

With regard to other veins and lodes in the course of exploitation or, for peculiar reasons, quasi-abandoned, it may be observed that I have this time had much better opportunities of forming an opinion than heretofore of the future prospects of the district, because in some of the mines a very considerable amount of work had been done, thus permitting closer and more careful examination. And, now that this has been done, there exist at the depths reached two classes of lodes, viz., *soft* and *hard*, and that thus far the tin ores occur in either are differing as much as the greater or lesser density of the vein-matter itself.

CROSS SECTION OF CUMBERLAND LODE.



EXPLANATION

- A. A. Coarse Granitoid Rocks
- B. B. Iode Shaded parts
- Tin Ore Deep black as pipe x.x. and in bunches, nests &c &c
- R Rich vein of ore beneath Adit Tieve

It is deemed necessary to refer to my former reports on this district in order to explain how far my views of *surface outcrops* of ore have been found to correspond with the lodes underground. With that view it may be observed that the numerous and, in many instances, rich outcrops of tinstone at Mt. Heemskirk, as first discovered in or before 1881, occurring either *in situ* or in close proximity to those lodes they come from, were since found to continue underground in the form of "shoots" and "pipes," or more irregular lenticular masses of ore. This explains the singular occurrence of so heavy fragments of ore (up to 50 lbs.) and the coarse angular gravels near those outcrops. These and other features demonstrate the prehistoric raising of the sea-beaches to their present altitude, and the gradual wearing down, by atmospherical and other influences, of the wall-rocks, leaving the denser and heavier ores almost where they occurred as lodes, shoots, pipes, &c. This view is confirmed by the occurrence on the plateau or foothills where most of the mines have been found of remnants of marine beds of rounded gravels and sands widely distributed to a considerable altitude above the present sea level. It was the discovery of these, so to speak, "*concentrated*" outcrops of pure tin ore that gave rise to so much prospecting—not always successful, as the outcrops were too far apart—and the subsequent, on account of encouraging results obtained, more systematic mining pursued ever since, as detailed below. It is, however, quite impossible to deduce from the extent, quantity, or richness of such outcrops any practically reliable basis for valuing the lode or lodes beneath such segregated deposits, thus confirming, in the main, the gist of my first report. Another reason for this view is that practically those outcrops represent really the aggregate results of accumulations of ore through denudation, &c., probably many vertical feet in height originally, and which do not account for the softer vein-matter that has now disappeared from the same process. The shoots of ore along the strike of lodes are therefore indicated by the "patches" and "nests" of ore at the surface, and the more and the closer they are together the better is the prospect for the output of ore from such a mine; and therefore it depends on these shoots, how comprehensively and rapidly these mines should be worked in order to keep the crushing and concentrating machinery fully employed. As already stated, the occurrence of the ore varies within the walls, but it may be accepted as a fact that in "soft" lodes ore shoots are more frequent than in "hard," where they are more irregular in nests, pipes, bunches, &c., and that in some cases shoots of ore occur only where the porphyritic dykes exhibit "cross-joints."

The term "lode" has been adopted after the same manner as in England, where such applies to more or less vertical fissure veins as well as tabular masses of tinstone.

All kinds of mineral or metalliferous deposits—lodes especially—have been subjected after their formation to interruptions in their regular course known as "faults," "slides," and "crosscourses," &c., which render their working frequently a difficult matter, requiring *practically experienced mining managers* well versed in lode-mining to be able to recover, in such cases, the missing parts of a lode so faulted. As these interruptions differ in all mining countries, no rule can be applied, but close observation will render the search a, comparatively speaking, very simple matter indeed. At Heemskirk two of these faults were observed, viz., at the Cornwall and the Cliff Companies' mines, and probably at the Empress also. They are described further on in this report.

Having now dealt with the general aspects of and the geological features observed at the Mount Heemskirk mines, it appears requisite to refer in detail to each mine examined, and likewise to describe the means adopted by the several proprietaries engaged in mining operations. The various processes for manipulating and dressing the ore by those companies having erected ore-dressing machinery are also tabulated for comparison, in order to afford the fullest information on every point of interest in connection with those tin ore deposits.

1. *The Cumberland Tin Mining Company.*

The Mines.—The principal veins and lodes, as indicated by the surface outcrops, have been fully described and delineated on plans with former reports. The mines have been opened by means of a commodious main adit, over 1000 feet in length, which is connected by means of a tramway (22 inches gauge) with their crushing and cleaning plant. At about 612 feet from the entrance to the tunnel a hard lode formation 6ft. 6in. wide was intersected, embedded between two soft granitoid walls, underlaying north, and striking nearly north by south. In an air shaft the same formation,—there 14ft. wide,—was again intersected. It carried a little ore, but showed in the air shaft no improvement. There are about 265 feet of "backs" open on this lode (?)—"a stanniferous and porphyritic dyke,"—but as no levels have been driven, which it would be difficult to make in so treacherous a stratum, its test is yet incomplete. At between 900 to 1000 feet "in" from the mouth of the adit another very hard lode formation, bearing north west by south west, was intersected. This is of a very much more promising description, and it exhibits all the characteristics of a true "fissure" lode, in which the vein-matter is represented by all those minerals so generally associated with tin ores proper. The vein-stone is highly quartziferous, contains but little mica, and the chlorites, fluor-spar, fine radiated tourmalines are, in places, strongly impregnated with tinstone. There is a very marked difference between this formation and the coarse-grained porphyritic wall-rocks in which it occurs. The ore itself occurs, irregularly distributed, in the vein in the form of nests, impregnations, cuticular masses and pipes: of the latter a good example was seen in the "rise," where an oblong

stem of pure ore, not more than two feet in diameter, was followed to a height of over 40 feet embedded in chlorites and tourmalines. Beside that, "nests" and bunches were met with, and, at the bottom of the north-eastern level,—where the lode is nine feet wide,—the top or "cap" of a rich "shoot" of ore was found to extend for over 30ft. in length by 12 inches in width, which presents a very fair prospect under foot. Altogether, this lode promises to be fairly productive as soon as the rise has been directly or indirectly connected with the surface, a height of 350 feet in the "backs." This lode, at the adit level, has been driven on along its course for only about 90 feet; consequently its full value as an ore-producing deposit cannot yet be estimated, but the indications are, so far, favourable to its becoming so.

It would be judicious for this company to consider the propriety of introducing rock-borers, driven by means of compressed air, for the more speedy opening of this lode and of their mine generally. As it is, the work in the "rise" is much retarded through slow ventilation. A rock-borer would aid the latter both by its exhaust air during boring and by opening the valves in order to drive out the powder-smoke, which renders the work—manual labour—as exceedingly unhealthy and protracted, considering the large amount of work yet to be performed in opening this lode.

The ore itself resembles a great deal that of Fawkner's lode, which furnished so heavy an outcrop of coarse and very pure lumps of ore.

The Crushing and Concentrating Machinery.—With regard to this part of my report, which is second in importance only to that of the occurrence of vein and lode tin-stone at Mount Heemskirk, the subjoined tables will afford every information of the treatment of the vein-stone to its final separation of concentrated tin ore obtained, and the waste rejected as valueless.

This company, it may be stated, has, in conjunction with the Montagu Tin Mining Company, which latter is located about 800 feet below the former, secured a more than sufficiently copious water supply by constructing an excellent dam across the outlet of that extensive "upland basin," in which most of the Cumberland Company's mines are situated. A string of wrought iron pipes, riveted together with cast-iron flange joints, leads to the battery below, and, by means of a very considerable amount of water pressure, the motor,—a horizontal turbine of a somewhat novel construction and of great power,—operates the whole of the crushing and dressing machinery. This consists of ten heads, two classifiers, two two-storied Lewis's buddlers, one slime buddle, a series of settling boxes, two sizing boxes, and a set of tubs, in which the sands in gyrating are made to deposit the finer slime tin, the whole process ending with strakes of blankets.

2. *The Montagu Tin Mining Company.*

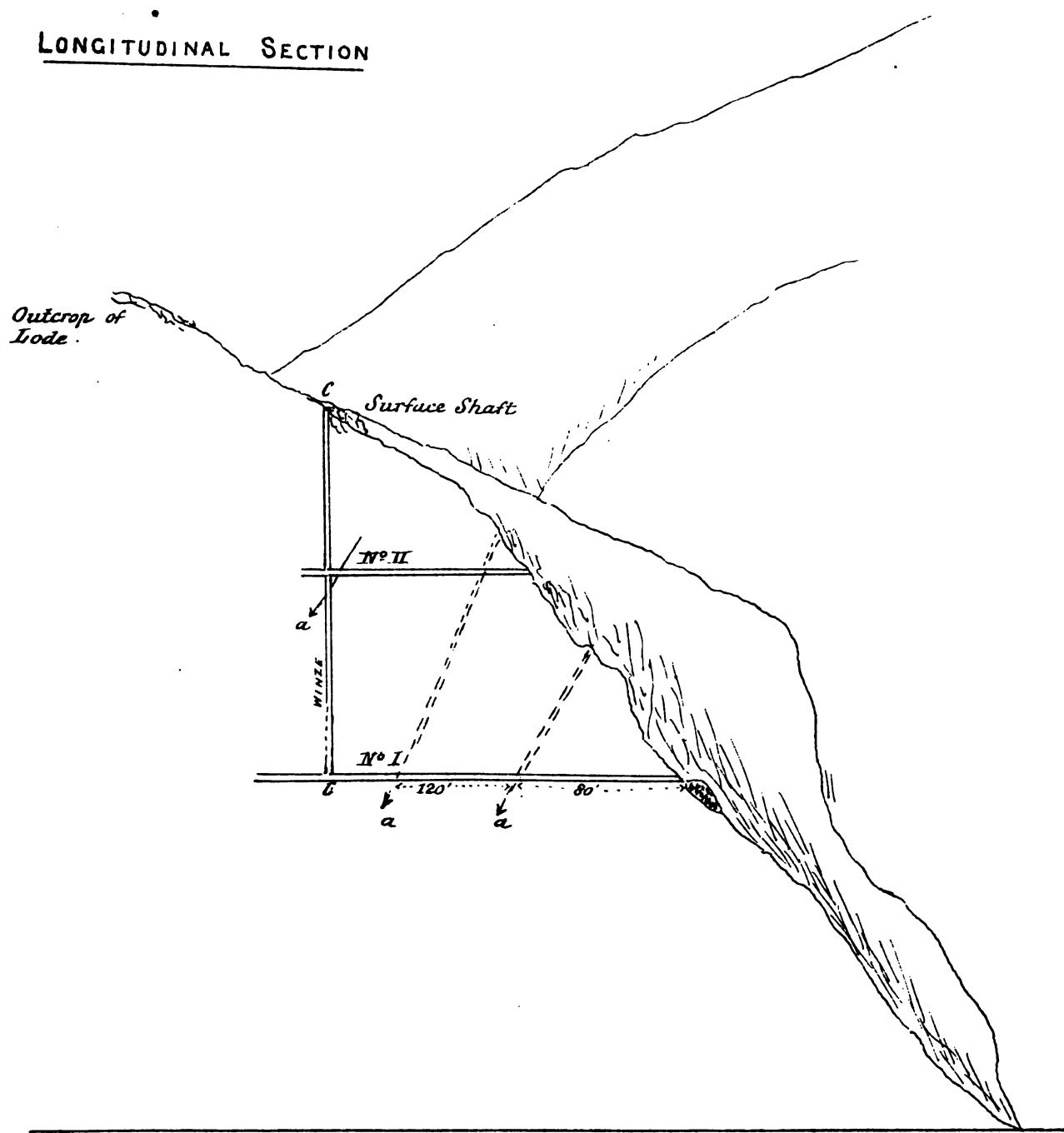
The Mines.—At the time of my second visit to Heemskirk, in June and July, 1882, this mine was flooded, rendering inspection impossible. At this present visit the same state of affairs prevail, with exactly the same result.

The Crushing and Concentrating Machinery.—As already stated, this Company undertook to construct, at joint expense, the large high level reservoir, together with a string of pipes for supplying both the Cumberland batteries, &c. and this Company's plant, now almost complete. A branch of pipes from the main supplies a smaller service reservoir constructed about 200 feet below the former. From the bottom of a "clearing" tank, filled from the smaller reservoir, another string of pipes has been laid (partly on the surface and partly on trestles), tapering from 9 to 5 inches in diameter, giving a head of water of 560 feet vertical, thus conveying at present the largest and most powerful available water pressure for motive power in Tasmania. The lower five-inch wrought iron pipes connect direct with one of Leffel's (American) "vertical" turbines, 4 feet 6 inches in diameter at the outer rim, and 3 feet diameter for the working part. By means of a pulley and gear an endless Manila rope, working in five grooved pulleys, instead of a belt, works the main gearing 60 feet distant. The present plant, which, with the almost unlimited water-power secured by this Company, can be considerably added to, consists of fifteen heads of stampers (with provision for five more), six classifiers, twelve of Sterry Hunt's (American) double-acting jiggers, two rotating and two slime tables ditto, or buddles (cemented bottoms), sizing boxes, labyrinth ditto, gyrating tubs and strakes, and other fixed ore dressing appliances.

3. *West Cumberland Tin Mining Company.*

The Mines.—The two principal lodes are the M'Williams' and Riddoch's. The former, bearing N. East by S. West, has been followed on its course by means of adits (at various levels) 165 feet and 270 feet in length respectively, averaging from 14 inches to over 2 feet in width. A shaft sunk from the surface to the upper adit gives 52 feet of backs, and in continuation to the lower adit 120 feet will be available for stoping. On Riddoch's lode the upper adit measures 55 feet and the lower 150 feet in length, and a winze of 70 feet in depth, from one to the other, gives the height of backs open for ore extraction. These two lodes, with some others not yet

LONGITUDINAL SECTION



EXPLANATION. *West Cumberland T.M.C.*

a a a Ore Shoots (3) Nº I and II Adits S. C. Winze

sufficiently opened up, though tin ore has been found on Hadley's lode also, represent in the aggregate a height of stopes of over two hundred feet, if the "backs" at each lode are added together. Altogether, since October, 1881, there have been over fifteen hundred lineal feet of chiefly ore ground opened up in this mine, presenting a very marked contrast to the, in too many cases, display of want of energy and vigour at Mount Heemskirk, without which, it is almost needless to say, no mineral region, however rich and endowed with the greatest natural facilities, can possibly progress or give satisfaction to those interested therein. The character of the ore and its peculiar mode of occurrence, as chiefly in soft euritic dykes of porphyry, present interesting features, having a decided bearing on the future treatment of same on the dressing floors; the tin-stone ranges from the very finest powder to a somewhat coarser kind, and it occurs principally in the form of "shoots" dipping easterly. So far, one of these shoots has been proved to exist on Riddoch's, and three on M'Williams' lodes. Generally speaking, the ore occurs in a fine slimy-like form, dispersed throughout the soft and decomposed vein-matter, and prospects taken at random, from No. II. especially, washed during my visit, were very satisfactory, and so were others, to a minor degree, from the other workings. At the same time, owing to the great fineness of grain, the stamping of same does not appear as necessary, as by it still more impalpable slimes are produced. Careful manipulation after passing through sets of sieves—revolving—so as to obtain uniform sizes of grain, and subsequent concentration on machines like the Frue's Vanning Concentrator, would in all probability give higher results than any other process extant. The coarser fragments not passing through the sieving machines should be fed to the stampers in the ordinary way.

So far, there have been no acidic minerals, such as fluorspar, &c. found as associated with the ore, but a kind of greenish micaceous mineral—most probably altered chlorites—appears to indicate the richer deposits when such are associated with arsenical and iron pyrites, both frequently transmuted, through decomposition, into a heavy black powder. From the surface the following features were successively observed, viz.:—1, rich outcrops of tin ores; 2, "floors" of micaceous iron ores, i.e., decomposed iron pyrites; 3, good tinstones—"cassiterites"; 4, "floors" of pure pyrites. In the bottom of the *winze* now in course of sinking between No. I. and No. II., in very soft whitish red vein-matter—"kaolin"—tin ore occurs of a reddish hue (ruby) in a very fine-grained slimy form. The character of the lodes change into a very hard quartzose matrix with the east and west lodes, in which the more abundant association with tourmalines appears greatly to displace those micaceous iron floors mentioned above. These lodes (east by west) are at times approached by a north-and-south lode, causing the latter to become very irregular, and to a degree they disappear altogether after driving a few feet on their course. The change mentioned of the soft "gangue" into the harder matrix is similar to that at the Peripatetic Company, but it remains yet unproven whether this alteration in density is favourable or otherwise to the future economic value of those repositories at a greater depth.

The Crushing and Concentrating Machinery.—Owing to the adits for mining the tin ore deposits being located at a vertical height of 370 feet above the dressing-floors, a self-acting single tramway 900 feet in length, and a more level continuation of same, connects the mines, with their reduction machinery. At the same time it may be stated that so far those mines have opened up satisfactorily, and that if that very fine grained ore can be saved or collected by the appliances adopted, the output of ore should be satisfactory in proportion to the capabilities of that machinery, which is rather circumscribed at present.

Water, by gravitation, as supplied from a reservoir constructed in a narrow glen above their crushing plant, is to be used as a motor; this embankment has been built chiefly of a decomposed gritty granite, faced in and outside with squared sods of peat. So far as could be seen, the material had no coherence, it being simply used to make up the bulk of the embankment without any ramming or puddling to give it resistent qualities to the pressure and percolation of water. Insufficient batter was also given to the in and outside walls, and as the discharging or supplying culvert for the wheel, together with the sectional capacities of the bye-wash, were restricted to limited deliveries only, it appears as doubtful whether the bank, if the reservoir was filled suddenly by the so very frequent local mountain freshets, would stand the pressure or prevent serious leakages. In case of any such mishap the plant below would most likely be very seriously damaged by the rush of water thus released suddenly. A well designed overshot water-wheel 20 feet in diameter drives a five-head battery, and the crushed material is then conveyed on to a couple of "centre head bubbles," also known, it is believed, as "Borlase's"; these bubbles are fed with the sands from the battery at the top of a truncated cone 3 feet in diameter by 4 feet at the base, by means of which the material will be equally distributed all round the base; the four revolving arms are furnished with strips of bagging or reeds, the action of which causes the resulting "water" to be discharged at the bottom of the depressed outer periphery. In this manner the concentrated ores will collect at the base of the central cone exclusively for removal at certain periods. A revolving slime-table or cleaning-bubble, to be followed by a couple of automatically acting "Dead Frames" will be eventually constructed, thus constituting a very simple series of apparatus for the proposed collection of tin ores and slimes.

The Peripatetic Tin Mining Company.

The Mines.—These are situate nearly ten miles north north-west of the Montagu Post Office. A considerable amount of work has been done in the way of testing and opening their tinstone deposits

to advantage. Those characteristically intrusive dykes of euritic porphyry enclose here also those ores, the metalliferous bands of which are enclosed in the coarser primary granite. The various workings have, in the first instance, followed the ore deposits from the surface outcrops in their peculiar manner of deposition; and secondly, with the practical knowledge thus obtained, the more permanent opening of the mines has been proceeded with in order to prepare for stoping the "backs" thereby disclosed. The matrix near the surface is soft and friable, chiefly feldspathic, and is very considerably associated with chlorites and tourmalines, with very fine and coarsish tin ores enclosed. The enclosing dykes bear to the north east, and at 23 feet from the surface, beneath a rich surface outcrop of ore, in an adit, a stanniferous formation was found underlying west. Near the blacksmith's shop good tin ore also occurs at a depth of but 21 feet from the surface in a chloritic vein ranging from 18 inches to 6 feet in width; it was here noticed that the ore is found in "shoots," in each of which the character of the ore varies from fine to coarse, as the case might be, though the vein or lode itself evidently belongs to the same formation. The dip of these "shoots" along the course of strike of the lode is evidently due to the inclination of "cross-joints" in the euritic wall-rocks.

Explanation of Diagrams.

Plan, a u, granite; b b, eurite: c, hanging-wall of lode; d, lode, consisting of streaks of ore and chlorites, parallel bands of coarsely crystalline iron pyrites and nests of tourmaline.

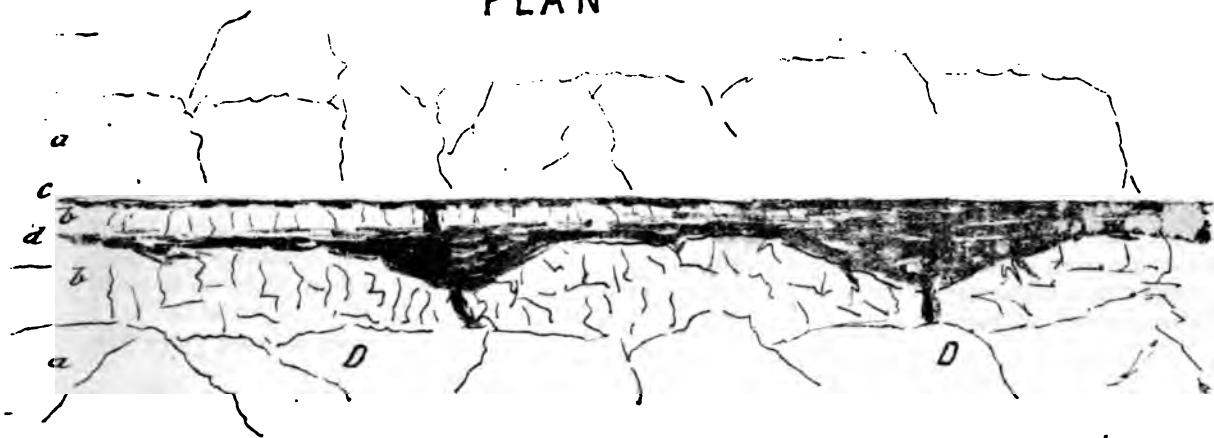
D D, cross-joints where the best tin ore occurs (as shown on longitudinal section) separated by eurites where the lode becomes narrower, and the ore more sparsely distributed. C shows the winze, which after passing through the centre of shoot has now entered the eurite again in the bottom, leaving the lower portion of the shoot intact. The distance between these shoots varies, and has been found to exceed 70 feet; the intervening spaces are still tin-bearing, but not so rich as those shoots. The underground workings or levels follow the narrow streaks of ore from north to south, and in No. 2 winze very good hard ore is exhibited in a feldspathic matrix with iron pyrites. The so-called "Mainstay" lode, disclosed in a still lower adit, belongs apparently to the same formation as those higher up, but it is more regular, richer, and the tinstones in regular veins alternate with parallel veins of iron pyrites, and not "floors" as described elsewhere. At the lowest adit in No. I. winze, diagram C, a hard quartziferous formation on a cross-joint is being exploited. This shoot of very strong tin ore dips also to the west, and the steatitic matrix is heavily charged with crystalline iron pyrites. The winze in question has evidently been sunk at near the lower end of the shoot, and by sinking vertically that aggregation of valuable ores has passed, at a depth according to its inclination, out of the winze. The several "ends" of the levels and workings still continue indications for the existence of other shoots of similarly rich ore, and altogether these deposits rank among the best and most promising on the West Coast. The working of these mines is much facilitated by the soft nature of the enclosing wall-rocks and the vein-matter within the same, so that as soon as a regular supply of water for dressing purposes has been secured the winning of ore can be commenced without any delay. It is contemplated to resume the sinking of the main engine shaft, now nearly 20 feet in depth, and located west of the lodes, as soon as the ores raised from the other parts of the mine have been thoroughly tested with the plant for ore-dressing now in the course of erection.

The Crushing and Concentrating Machinery.—A reservoir had been formed in a creek below the mines, and the material used for the construction of the embankment was found to be precisely the same or, rather, similar to that at the dam of the West Cumberland Co., also faced with squared sods of peat, &c. A sudden freshet in the creek from the mountains had carried it away on the day before my inspection, whilst also doing very considerable damage to the machinery partly erected lower down on the same creek. And so far as the uninjured parts of that plant would permit one to see, the battery (10 head), water-wheel, four Cornish buddles (Borlase's), &c. were on the same pattern as those in course of erection at the West Cumberland Co.'s mine. As the ore in both of these mines is of a very similar description, the results may be anticipated as proportionately of like character.

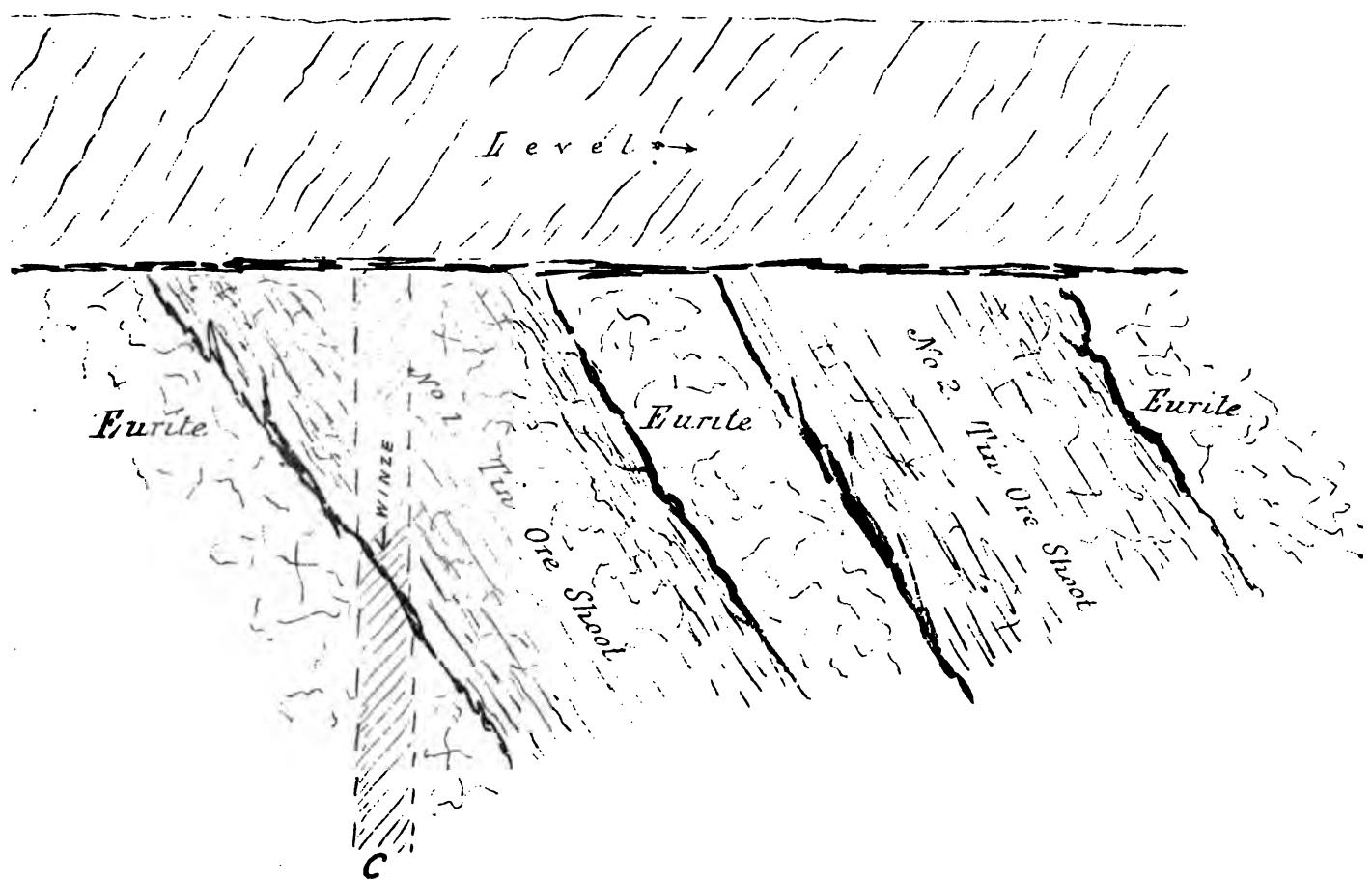
The Champion Tin Mining Company.

The *Mines* are located at North Mt. Heemskirk, about four miles easterly from those of the Peripatetic Co. An outcrop of ore having been discovered high up the range from a creek, the top adit below the former was driven for a length of 331 feet, and the tin-bearing vein again intersected gave so encouraging prospects as to induce the owners to come still lower down the range and drive another, or their present main adit, which had reached a total length of 280 feet, leaving only some 30 feet before the tinstone would again be intersected. Their main lode, and another near the mouth of the adit, have a south-easterly course, and in the upper adit, at 320 feet, a branch of good tin ore carrying vein-matter was found from 18 inches to 2 feet in width. The whole country consists of a very dense and extremely hard *porphyrite*, here and there containing nests and pockets of tourmaline, copper, iron pyrites, and some fluor spar. A prospect taken from the vein in the upper adit gave on washing both ruby and black tin ore. Owing to the excessive hardness of the strata, it is doubtful whether these tin ore deposits will pay for working in the ordinary way of remunerating the miners on this West Coast, though it is quite possible that at this and several other mines the tribute system would prove beneficial alike to employees and employers. No reduction machinery has been erected at this mine, but both water supply and sites are favourable for the same.

PLAN



LONGITUDINAL SECTION



The Cornwall Tin Mining Company.

The Mines.—Since my last inspection, in June, 1882, the mining operations have had but very little attention bestowed upon them, and it is reported that the ore saved for crushing, from a vein on the east side of Packers' Creek, after passing through their crushing and dressing plant (also erected since), did yield but very little ore. After that, a discovery was made on the western side of Packers' Creek, and several tons of ore were saved by the concentrating machinery, and shipped to Melbourne. That deposit, however, was soon after abandoned, I am informed, on account of the ore, at but very few feet from the surface, being found to rest upon and being cut off by a hard floor of granite. On examination of the old workings it was discovered that that floor was covered by a vein of unctuous greyish clay, and that this seam dipped to the north; there was every indication, besides, of the upper portion of this deposit—now removed—having been displaced in a northerly direction through or by means of a “fault” or a “slide.” It would take but little trouble to prove whether this is, or not, the correct view, especially as the ore was very rich, I am informed; in any case, so promising a deposit should deserve a further trial. Previous to any more permanent work being undertaken, such as for instance, a main adit from near the crushing-plant, the exact angle of “dip” of that “fault” or slide should be ascertained, in order to be able to plan the future operations with every possible accuracy.

The Crushing and Concentrating Machinery.—This powerful and comprehensive plant has been unfortunately placed in an almost inaccessible position on the sea coast, whereas as good and better sites could have been found inland on Packers' Creek, which stream even now supplies the water as motive power, necessitating however the construction of a large tunnel through which it is led in a circuitous manner to the head sluice at the waterwheel. The plant has been completed since my last inspection, and it was observed that it evidently required better care and attention as regards cleanliness, &c. An overshot waterwheel 40 feet in diameter, 4 feet breast, works a 10-head battery, from which the crushed ore is fed to two *Frue's Vanning Concentrators*, which were fully described in my Report for 1882 as Inspector of Mines, and of which the mining manager has given testimony that they have afforded the greatest satisfaction. The thereby impoverished sands are then supplied to two of Borlase's buddles, the four arms of which are furnished with split canes instead of bagging or iron scrapers, and finally, cleansing the ore and of slimes are effected on a third Borlase's or slime table, followed by a treatment in a hydraulic “cleaner” and a series of settling-boxes. The ores were strongly impregnated by tourmalines, and therefore offered, on the buddles principally, and not on the Frue's Concentrators, very considerable difficulties in separating that fibrous mineral from the ores, as it formed a kind of dense matting, which, on a firm bottom like that of the buddles, became as solid as a concrete. On the Frue's Concentrators, I am informed, no such matting could possibly take place, as there was not such a solid, but an ever vibrating resistless bottom on their endless and revolving wide India rubber belts.

The Cliff Tin Mining Company.

The Mines.—But very little work had been done here; and that extensive deposit or lode, the outcrop of which I traced in 1881 for over one thousand feet in length, had scarcely been touched at all. A few tons of surface tinstone had been removed for crushing, and a shaft had been sunk to less than 20 feet in depth. Notwithstanding the very favourable indications on that lode, more attention has been devoted to two other lodes nearer the sea coast. My informant showed me what has been termed the “junction lode,” which bore nearly north by south, and the whole of it for a length of about 75 feet by a width not exceeding two feet, as well as its rich surface sheddings, had been sent to the battery. Very good ore was traced here to a depth of about 25 feet, when an interruption to its regular course took place, in precisely the same manner as at the Cornwall Company's mine, by a “slide” likewise dipping to the north; after sinking six or seven feet only on this slide, no further attempt was made to trace same to the missing part of the deeper lode. From the description given me of the angle at which the slide dipped, and as the inclination of the upper part of the lode was still in view, the continuation of that deeper lode should be sought for beneath the Cliff Creek, to the north of these present workings. The other, or east-and-west lode, a few chains nearer the coast line, although differing in its lines of strike, may, as well as the north-and-south lode, be taken as the one lode only, as it appears quite likely that a strong dyke of euritic porphyry occurring about midway between the two, and crossing their strike, has caused their disconnection; in both the vein-matter is similar, though at the surface the east-and-west lode produced the richest ore as embedded in chlorites. However that may be, this last lode was very rich to about 17 feet from the surface, I am informed, when it was also cut off by a “slide” or a fault, and has not been, so far, traced to a greater depth. At its outcrop a vertical shaft was sunk to a depth of about 70 feet, but, as both the lode and the fault trend to the north, the shaft has been of no use whatever in exploiting the mine, because, with increasing depth, the greater the distance would be from the lode in question.

The Crushing and Concentrating Machinery.—Like the Cornwall Company, this proprietary, without in the least regarding the future supply of ore for treatment in the dressing-sheds, as will be seen from the fact that they had but 17 feet in one place and about 25 feet of backs on another lode

in sight, on shoots of ore not exceeding 75 feet in length each, have also erected a crushing and concentration plant. They are very badly situated for water, the supply of same for motive-power being very limited, as their gathering area is small, and the shallow creek draining same is very frequently quite dry. Not less than three dams have been built across this creek, of which, however, two were soon destroyed on account of the faulty design adopted, and of the unsuitable material used in their construction. They were about 10 feet wide on top, with an inside batter of but 2 feet in 12; outside batter, 3 feet in 14 feet. A kind of puddle trench was formed throughout their length in the centre, but as the clay used, instead of being impervious to water, was of a gritty and sandy character, these two (upper) dams were soon demolished by the sudden freshets so characteristic of Mount Heemskirk. The lower (remaining) dam, of an improved design, alone remains for the use of the plant, which consists of an overshot waterwheel 18 feet in diameter, 4 feet breast, which works five heads of stampers—provision made for another five. The crushed ores are discharged into three connected Cornish tyes, thence into three similar strakes, which feed two of Borlase's buddles, constructed on the same principle as those at the West Cumberland and Peripatetic Companies' mines. The slimy residues, after collecting the coarser ores at the base of the truncated cones, are then treated on automatic "dead frames," hand-dressing tables, and finally in "tossing-tubs."

The Empress Tin Mining Company.

The Mines.—Of this, as well as that of the Montagu and Montagu Extended, nothing positive can be said, because of their workings being filled with water; and in giving the following statements—as I have in this Report of also the Cornwall, Cliff, and Montagu mines—it should be borne in mind that, as they were not working or accessible for inspection, those statements are only iterations of explanations and descriptions given to me, and noted at the time in my field-book, by the Mining Managers or the persons left in charge as caretakers. In doing this, the completion of this Report was principally kept in view, and I cannot vouch for the correctness or otherwise of their statements.

This Company has erected the only steam winding and pumping plant on the West Coast, being supplied with steam from a Cornish flue boiler—multitubular—for a horizontal 12-inch cylinder engine, driving a double winding-gear and pumping-gear with seven-inch lifts.

The shaft has been sunk to a depth of 111 feet, and has been opened out at the 105 feet level. Water stood at the time of my visit at the 53 feet or adit level, operations having ceased for some time previously. I was informed by the Mining Manager left in charge that the last tin ore beneath their rich surface outcrop had been met with at a depth of only 27 feet in their main shaft, and that from that point the "lode" had been followed vertically without meeting any more ore. It would thus be seen that ore occurred from the surface down to 27 feet; none from there to the adit level (53 feet); and none to and at the bottom level (105 feet); but that the Mining Manager anticipated, for some occult reason or other, to strike ore again at still greater depth in the "lode" followed. The lode below the 27 feet level is described as nearly vertical, with an underlay of 1 in 3, and levels had been driven on its east-by-west course for a total length of 160 feet at 105 feet from the surface. In these levels, at 36 feet "in" from the shaft, the supposed lode was found to be of the same size, measuring from the hanging-wall, as at the adit or 53 feet level; and that, in the soft country to the north, the anticipated junction with the north-and-south lode had not been met with. After very close examination by means of very powerful lenses of the upper or really tin-carrying stone, and that from the lower continuation (supposed) of same below the 27 feet level, I found a remarkable difference. The upper *tin-bearing* lode is embedded in a foliated euritic porphyry, with orthoclase predominating, and very little quartz. The supposed lode beneath the 27 feet level exhibits, instead, a highly quartzose porphyry, charged in places heavily with arsenical, iron, and copper pyrites, with tourmalines, and is therefore (from a mineralogical point of view) decidedly different from the former. As the shaft was timbered up I could not very well make a closer examination, but would suggest that that Company should cause the shaft to be opened out at the 30 feet level and ascertain whether, as I have good reason to believe, a fault, so prevalent on that line of country, has not displaced the lode from its original course, and that the continuation of same does not exist, as averred, in the lower metalliferous porphyritic dyke most probably mistaken for the "lode." If such assumption be correct, then the present shaft could be utilised without adding to its present depth, as is, I understand, contemplated.

The Orient Tin Mining Company.

The Mines.—It may be stated that a very considerable amount of prospecting and other "dead work" has been done here since my last visit, without, however, it is to be regretted, leading to the discovery of productive or remunerative tin ore deposits. As regards the work done, the measurements given me by the mining manager are as follows:—"Shafts sunk, 110 feet; cross-cuts driven, 1120 feet; driven on the course of veins and lodes, 615 feet,—or a total of 1845 feet: and that 360 tons of ore gave 55 bags or 2 tons 15 cwts. of cleaned ore." The original outcrop (Thorne's) has not had so much attention given to it at or near the surface as it undoubtedly deserved, and the

numerous shafts, air-shafts, levels, cross-cuts, and adits, all excavated some distance away from that outcrop, constitute quite a large mining concern. It is not deemed necessary for the purposes of this report to describe every one of these workings, but to state the result of my very careful examination of the various deposits and of the close inspection of all the workings, with a view of connecting same with the opinion formed as to future prospects. In doing this, the percentage of ore said to have been obtained from the various ore bodies and particularised by the mining manager are discarded, for the reason that they do not, in my opinion, convey a correct idea of the value of such ores; and that without stoping, and taking quite a series of such tests systematically and for a considerable length of time, they are more apt to mislead than to guide.

In the 50 feet adit a shoot of tinstone was, near the entrance, met with, having a general trend towards Thorne's outcrop; but instead of driving on its course in that direction, the adit has been made to cross same obliquely, and, consequently, is driven *beyond* and *away* from it. This will be better understood by stating the bearings of the lode at N. 42 E., and of the adit at N. 58 E. As that ore-shoot contained a little tin, dipped and trended towards Thorne's, it would have been but reasonably judicious to follow it, or its continuations from that or other points, so as to get beneath that rich outcrop. As it is, I am informed, the only other place where Thorne's is supposed to have been met with is in a cross-cut in the 85 feet level below, where a similar vein has been intersected, but not tin-bearing, which is not an unusual circumstance by any means in that district.

In the strictly granitoid country traversed by intrusive eurites several poor veins of tinstone have been found, and traced severally for considerable distances. No appreciable results followed, only it was observed that they, so to speak, "*thickened*" at irregular intervals, thus forming shoots, which generally led up to *very* moderate increase of ore at those parts. In one or two instances these were proved to dip beneath the bottom of those levels.

In the metamorphic clayslates, "*killas*," (south of the 50 feet adit), at the 85 feet level, three or four air-shafts tend to ventilate a main drive, from which four crosscuts have been driven easterly on as many veins, of which the first two consist all of pyrites, the third of quartz and pyrites, and the fourth the same, with a fair prospect of tin ore; but as that vein is only from 6 to 8 inches thick, and the others even less, they cannot be worked with any prospect of profit. Those narrow veins underlaying at various angles are likely to join at a depth the No. 3 vein, but the fact appears to be that there are too many of these narrow veins in the slate country to render such a junction sufficiently extensive or rich to sink deeper, so far as present appearances indicate. Singularly enough, in a level driven west from No. 3 shaft for a distance of 60 feet through slate, the granite country was met with, and a fairly promising deposit of ore was found to exist within the contact lines between the primary and secondary rocks. This may be considered a favourable indication to follow up, and to test further by means of a prospecting level, keeping those two rocks at either side and the "*joint*" in the centre, because it is quite possible that some of these or other veins occurring in either rocks may have formed ore deposits there, and it is just as likely that such, if intelligently followed, may lead to the discovery of stronger lodes thereabouts. Experience has taught miners that it is more judicious for them to *follow* any real ore deposit than propound theories which, though may be successful in one district, are not likely to be so always in other mineral regions, although with the same kind of ore.

Their deep adit, which has been started considerably below the hoppers at the battery, has been driven for a distance of 300 feet, and it will eventually give 50 feet under the present bottom of the whim shaft in this drive. Thorne's lode, it is believed, was cut at 250 feet, very regular and fairly tin-bearing; further on the Wheel Lode, which was exposed when making room at the hillside for the ore-crushing and dressing machinery, was intersected at 250 feet in front of the entrance, for a width of 12 feet, carrying a little tin-ore, but not at all tested further. Another small lode, one foot wide, designated the Dam Lode, also somewhat stanniferous, and at the end of this adit promising spurs three inches thick were discovered. Having now briefly described all their tin-bearing deposits, there remains nothing but to draw attention to a feature which is likely to have a direct bearing on the future prospect of this mine, if the indications observed are accepted as a guide. In the southern portion of these leaseholds all the spurs, veins, and outcrops underlay to the west, and in the northern ground they underlay east, thus forming an extensive synclinal section, the Wheel Lode being the exception, as that is very nearly vertical; that lode must, therefore, from all appearances come into contact with those northern and southern poor tin-bearing veins at either side of the former. It is quite possible also that where that Wheel Lode comes into contact with the granite there may be a fair deposit of ore, and under any circumstances with the evidence to hand it would be judicious to test the "*joint*" between those two formations in a thorough manner. It should be mentioned that the Wheel Lode, where intersected in the deep adit, though greatly decomposed and containing much soft argillaceous vein-matter, it still yielded fair prospects of ore; the outcrop of same close to the water-wheel had also a good appearance, consisting principally of euritic porphyry with chlorites, and the whole being interspersed with attenuated quartz-veins, and it has been proved tin-bearing there also.

The Crushing and Concentrating Machinery.—These consist of ten heads of stampers driven by a portable 13 h.p.-engine with two cylinders of $8\frac{1}{2}$ inches in diameter each, by means of a belt to the pulley on the crank-shaft.

The ore-dressing appliances are worked by means of a water-wheel 10 feet in diameter, with a breast of 2 feet 4 inches; first there are two of Munday's Patent Buddles, which empty themselves at the top of a channel lined with bagging for the interception of fine tin-ores encircling their outer periphery; the ore is then collected by means of trap-doors worked by screws and levers. The second quality of ore-sands is then conducted to two similar outside buddles, where the process is repeated; from there they are fed into a hydraulic concentrator with a sieve in the bottom, worked with fifty feet (or head of) pressure per square inch. The whole works are supplied with water from a reservoir constructed at an elevation above the batteries; they are well housed in, and though it must have cost a very considerable amount of money to excavate the site for same out of the hill-side, the whole are well arranged with a view of saving manual labour.

The above are the mines, the proprietaries of which have, under considerable difficulties, persisted in the development of their respective ore deposits, and they have, in some instances, somewhat prematurely erected winding, pumping, and ore-reduction machinery.

So far as my examination of these tin-bearing repositories above described is concerned, I can see no reason to depart from what I stated in my first Report, No. 82, 1881; viz.:—“Without the slightest doubt Heemskirk will, in the course of time, if the mines are continuously and efficiently worked, become a place of importance to this Colony;” and in the concluding portion of that Report, speaking of these deposits, viz.:—“They possess features which have shaped my opinion to be very favourable to their future behaviour when properly and systematically mined at lower levels than reached hitherto,” &c.

Three years have elapsed since that was written, and it cannot, I submit, be said with any degree of truth that either of those conditions have been carried out to the extent required. There were in 1881 over 150 miners engaged in *mining proper and in prospecting* the very large number of leases taken up by capitalists and speculators; and it is questionable now whether the *seven* companies mentioned in this Report employ more than 50 men—not, as then, for mining exclusively, however, but as mining managers, engineers, ore-dressers, carpenters, caretakers, stamper-feeders, &c., so that the mines are being, even now, developed by a small minority of the former, thereby retarding the most important works underground. It is to be hoped, now that the production of tin ore is about to commence, that this will be materially altered, and that all those deposits will again receive renewed attention, if not on the wages', then on the tribute system, which latter works so well elsewhere. There cannot be any doubt that, as also stated in my Report of 1881, “the pernicious system of holding a large number of sections . . . for speculative purposes only,” &c., has had, in combination with the unsupported statements by unscrupulous speculators of dividends (?) accruing shortly to holders of Heemskirk stocks, &c., a very depressing effect generally, resulting in the cessation of mining operations in many cases.

With regard to the various ore-dressing processes now tabulated, it may be observed that vein-stuffs, of whatever character, require more care and attention in treatment than is generally believed. Some of these Heemskirk lodes contain minerals possessing almost the same specific gravity as the tinstones (“cassiterites”), thus presenting great difficulties in separating same from each other. Then, again, at the lower levels, sulphides or pyrites appear to become largely associated with those ores, which will add considerably to the difficulties in separating and collecting the pure tin ores. For these reasons, any ordinary, or, it may be observed, any less scientific manipulation must necessarily eventuate in the loss of considerable percentages of ore, because proper classification as to “size of grain” and the collection of cleaned ores at *successive stages* during the concentration processes, is not included in the former. The object of separating or classifying progressively the coarser from the finer sands, and ultimately of the slimes also, is in the first instance to obtain successively the coarser and purer ores with every size of grain, until each class of reduced size of grain has been made to give up, as it were, by the action of proper machinery, its pure concentrated ore. With the cruder processes the crushed ores are treated for the tin they may contain as a *whole*, without classification of grain as to size, consequently some considerable portions have to be treated over and over again, and the mingled coarse and fine sands subjected together to the same hydraulic processes cause the finer and more valuable slimes to be lost together.

From the tables now submitted it will be perceived that some companies have adopted the more simple and ancient method for cleaning their ores; others, again, have introduced more elaborate systems of treatment by means of machinery which may be, as yet, regarded in the light of expensive experiments, and the importance of classification of grain has been recognised by but one company. In the first case, so to speak, a misplaced desire for economy and an objection to stepping outside of an old observed groove, now almost obsolete, has resulted in the adoption of designs and the erection of very simply constructed machinery defective from a technical point of view; and in another instance the other extreme has been reached by the adoption of too cumbersome and too complicated appliances, requiring, at the expense of excessive motive power, (happily no obstacle in this particular case,) constant, and laborious attention, together with continuous regulation of parts, and expensive repairs.

With a district like Mount Heemskirk, where the output of tin ore, by means of the appliances described, is an event of paramount interest to the public at large, matters must now be allowed to take their course, as most of the necessary machinery has been nearly completed ; at the same time it is as well to draw attention to these matters so that they may be remedied at some future time, because, after all, the economic value of the Mount Heemskirk tin ore deposits can only be correctly gauged by the resulting output of pure ores, and any augmentation of same by means of more effective "cleansing" apparatus or appliances, becomes, doubtless, under the circumstances, most desirable.

Bearing in mind the undeveloped state of most of the Heemskirk mines, there is now more than sufficient machinery for all purposes erected to serve the purpose for a considerable time to come, unless new and extensive discoveries should be made.

G. THUREAU, F.G.S.

COMPARATIVE TABLE showing the various Methods adopted at Mount Heemskirk for Dressing Vein Tin Ores.

NOTE.—In the following the manipulations or cleaning processes are shown for a five-head battery only.

THE CUMBERLAND COMPANY.

Turbines.—One (horizontal). **Actual No. of Heads.**—Ten. (Provision made for other five heads.) **Gratings (holes per square inch).**—80 to 100.

Process.—Crushed sands on to splash-boards, into rotating and concentrating tubs ; coarser sands to two-storied bundle (a). Slimes to rotary slime table (b) and pyramidal sizing boxes. Clean tin into settling boxes, residues into gyrating tubs and strakes lined with bagging, into tossing tubs. Clean tin (c)—Wastes.

THE MONTAGU COMPANY.

Turbines.—One (vertical). **Actual No. of Heads.**—Fifteen. (Provision made for other five heads.) **Gratings (holes per square inch).**—80 to 120.

Process.—Crushed sands on to splash-boards supplying St. Arnaud Classifier (two), to Sterry Hunt's American double acting jiggers, producing—No. I., coarse sand (clean) (d) enough for tubing ; No. II., fine slimes—into pyramidal sizing box and No. I. rotating table or bundle ; thence into three labyrinth settling boxes : No. I., part "clean tin," (b), No. II., part to hand-bundles, residues to No. II. rotating table for slimes. These empty into two labyrinth settling boxes—clean tin (c)—overflows and residues into gyrating tubs, in which, by means of a jet of water striking the inner circumference (on the top of the water) of the tub obliquely, a gyrating motion to the sands suspended in the water is given, tending to effectually settle all heavier mineral particles in the centre.—Clean tin. Residues over strakes (d) lined with bagging—Wastes.

THE WEST CUMBERLAND COMPANY.

Water-wheels.—One. **Actual No. of Heads.**—Five.

Process.—Crushed sands on to splash-boards direct on to "centre-head bundle" (17in. diameter), thence on to second "centre-head bundle ;" to be followed by a "dead frame" for cleaning the ore. The latter works continuously and automatically, and is intended for collecting finest tin. Clean tin—Wastes.

THE PERIPATETIC COMPANY.

Water-wheels.—One. **Actual No. of Heads.**—Ten.

Process.—Crushed sands on to splash-boards, direct on to centre-head bundle to three labyrinth settling boxes, thence on to second head-centre bundle, to be followed by a "dead frame," working continuously and automatically, and is intended for saving finest tin. Clean tin—Wastes.

THE ORIENT COMPANY.

Water-wheels.—One. **Steam Engines.**—One. **Actual No. of Heads.**—Ten.

Process.—Crushed sands on to splash-boards in to receiving-tank, by Launder's to Munday's self-emptying bundle ; strakes at periphery lined with bagging (a) ; on to second bundles for slimes ; final cleaning of ore in a hydraulic and automatic concentrator. Wastes into settling boxes for reworking. Clean tin. (b)

THE CORNWALL COMPANY.

Stonebreaker.—One. **Water-wheels.**—One. **Actual No. of Heads.**—Ten.

Process.—Crushed sands on to splash-boards, supplying a Frue's Vanning Concentrator (c), residues and wastes to Borlase's Budle ; slimes on to a second Borlase's Budle (cemented bottoms.) Impure tin ore through hydraulic cleaner and settling boxes. Clean tin. (b)—Wastes.

THE CLIFF COMPANY.

Water-wheels.—One. **Actual No. of Heads.**—Five. (Provision made for other five heads.)

Process.—Crushed sands on the splash-boards to Cornish tyes to Cornish strakes, on to Borlase's Buddles ; thence to automatic dead frames, hand-dressing tables, and finally into tossing tubs. Wastes—Clean tin.

(a) (b) (c) (d) showing collection of concentrated ores during the process.

G. F. THUREAU, F.G.S.

TABLE showing different kinds of Machinery employed at Mount Heemskirk.

| | | | |
|------------------------------------|-----|-------------------------------|----|
| Stonebreaker | 1 | Labyrinths..... | 16 |
| Steam engines | 2* | Settling boxes..... | 15 |
| Turbines | 2 | Hydraulic concentrators | 2 |
| Water-wheels | 5 | Tossing-tubs | 4 |
| Heads of stampers..... | 65† | Gyrating-tubs | 27 |
| American classifiers | 6‡ | Strakes | 12 |
| Automatic jiggers (American) | 12 | Tyes | 3 |
| Frue's concentrators..... | 2 | Pyramidal boxes | 4 |
| Buddles (rotating) | 11 | Hand-buddles..... | 2 |
| Slime tables | 9 | | |

* One of these steam-engines is used for pumping and winding—horizontal, with Cornish flue boiler, &c. The other is used for driving a ten-head battery of stamps.

† The stamps are all arranged in five-head batteries, and as provision has been made for other ten heads additional, there would be eventually seventy-five heads of stamps working in fifteen boxes or batteries.

‡ To these six American classifiers, of double capacity, two more, of Mr. Lewis's invention, should be added; the former are self-acting, and the latter are rotating in cylindrical tanks, by means of belting from the main shafting.

G. THUREAU, F.G.S.

(No. 180.)



1884.

PARLIAMENT OF TASMANIA.

**WARATAH AND PENGUIN MINING
DISTRICTS :**

REPORT BY G. THUREAU, ESQ., F.G.S.

Presented to both Houses of Parliament by His Excellency's Command.



REPORT ON THE WARATAH MINING DISTRICT.

Launceston, November, 1884.

THIS district was carefully examined in March last; and other pressing business requirements, including a tour to the West Coast and the North-Eastern Mining District, have prevented the compilation of the following paper on the subject.

The Waratah Mining District, already so famous for its extraordinary richness of the extensive tin ore deposits, occurring within, comparatively speaking, a limited area of ground, possesses other valuable features of interest to the mining community more immediately interested and to the Colony at large. These consist in other metalliferous deposits of a very promising character, leaving, however, the stanniferous formations predominant for the present and for a considerable time to come.

The tin ores occur here in well defined lodes; also in large deposits of hydro-thermal origin, and in drifts belonging to the Pliocene epoch.

The other ores represent galena, zinc, antimony, copper, iron, &c. and these occur mostly in veins or lodes, and also as impregnations of wall-rocks.

Though fluorspar occurs frequently, tourmaline appears to be absent.

All these metalliferous deposits occur in metamorphic schists and Silurian slates and sandstones, traversed by dykes of that species of porphyrite known as "eurite," a crystalline-granular mixture of quartz and orthoclase, of a white colour where exposed on the surface, but yellowish-brown where not exposed to the weather. Some of these dykes are heavily charged with iron pyrites of cubical crystallisation. The vicinities where these euritic dykes have protruded the schistose rocks is characterised by the prevalence of anticlinal, synclinal, and other sections with those sedimentary formations, as shown by the diagrams herewith. Strong evidence also exists of an ancient river system, now filled with Pliocene drifts and clays. The latter have become indurated, and exhibit in well preserved forms the pre-historic remains of plants so characteristic of that epoch. The diluvial drifts are in the north capped by very extensive sheets of basalts, viz., the upper and lower, intercalated by a stratum of scoriaceous clays and volcanic ashes, from white to black in colour. Near the Mount Bischoff Company's crushing works that lower basalt exhibits, in angular forms (brecciated), a layer of eurite evidently derived from the dykes referred to, and this basalt rests immediately on the diluvial drifts which, in that locality, have been found to be charged with tin ore.

In order to arrive at any fair deduction as to the permanency of these various metalliferous deposits, it is necessary to state the results of the examinations made for that purpose, and in this manner deal with the present aspect and the future prospects of the whole Waratah mining district.

That the protrusion of the euritic dykes through the Silurian and metamorphic rocks was antecedent to the formation in fissures of the metalliferous veins is proved by the latter frequently continuing to occur in those dykes (Stanhope Company's diagrams) for some distance, dwindling, however, to mere threads eventually. After the formation of these lodes and veins charged with tin ores, also of lead, antimony, zinc, copper, and iron, I opine the formation of those stupendous tin ore deposits at the "red face," or comprising that famous "mountain of tin," so well known all over the world, may be safely said to have taken place.

Careful study of this subject has resulted in the following:

The country rocks in the more immediate neighbourhood of that rich nucleus of tin ore has, it may be remembered, been proved to contain numerous metalliferous lodes and veins. On reference to the geological sketch plan furnished with this report, it will be seen that between the crests of Mount Bischoff and west of the "red face" a massive tin-bearing lode occurs, bearing S 27° E. This is almost vertical in position, and at considerable depths from the surface. All those remarkable aggregations of lodes, both in the Stanhope and Mount Bischoff Company's ground to

the north east, must eventually come into contact with the main lode, which is of a strong chloritic character, and over 120 feet in width at the surface. The occurrence of the "red face" stanniferous deposit immediately above that junction referred to, and the general features of the same, render it quite possible that those particular tin lodes, seated at great depths, have, by some means or other, enriched those well known surface deposits.

It is on record that other mineral and metalliferous districts, notably in America, at the Yellowstone River, for instance, and also near Carson City, State of Nevada, are now covered with "dead" or dying hot water springs or "geysers," to which class also belong the hot mud volcanoes or springs of South America. All these resemble to a very great extent what is observable now at Mount Bischoff. Some of these "geysers" leave a deposit of fine black mud or fine sand, with irregular blocks of rock, at the outer margins of these remarkable "vents" of the earth's crust, whilst others, deprived for ages past in all probability of their former hydro-thermal activity, are now entirely closed by siliceous deposits, which differ altogether from the country rocks in their immediate vicinity. Near Carson City, Nevada, U.S.A., on the same line of country as the celebrated Comstock lode, I observed several mud-springs in action, which are depositing concentric layers of siliceous matrix around the "vents." These have, on assay, been proved to contain both gold and silver, similar, but poorer, than the quartz matrix of the Comstock lode.

The red face deposit of tin ore resembles in many respects what has been said of the American deposits. We have here, on the outer margin, on three-fourths of the sides of the depression now filled in, fine sand, blocks of porphyry and detritus, with occasional layers of rich tin ore, which here takes the place of gold and silver; then follow greyish muds and clays, which are distinctly observable on the way to and at the Don Company's workings, where they pass eventually into a channel beneath the basalts. Lastly, the central portion, or the "red face" workings proper, disclose a siliceous deposit stained a brownish red by the decomposed iron pyrites, which occur in their original state and unaltered, at the 33-feet levels driven beneath the present working level. When that brown matrix, now so extensively mined, is carefully examined under powerful lenses, it will be seen that the whole of it consists of small crystals of quartz closely impacted together; and this mass eventually closed the "vent" in which, by means of hydro-thermal action, the tin ores ascended as metalliferous vapours, together with mineral and acidic gases, which, on condensation nearer the surface, caused the impregnation of the matrices, now worked, with the cassiterites, that give so great a value to this tin ore deposit. If such an underground outlet or "vent" existed,—and of which there is such very strong evidence,—then in its ramifications it must have broken through all those strong stanniferous veins and lodes when such were in course of formation; and in this manner the origin of those secondary deposits (red face) may be accounted for, whilst at the same time affording substantial evidence of the future permanency of same. The intrusion of the euritic dykes caused a very considerable amount of dislocation in the Silurian and metamorphic strata, and, consequently, the now observable irregularity also of the metalliferous veins and lodes, thus exhibiting a variety of those deposits which, with cheaper labour, a regular supply of suitable fuel for the reduction of those ores in furnaces on the spot, or, at any rate, at Emu Bay, will afford employment to many persons for a considerable time to come.

The diluvial (Pliocene) deposits have not yet been exploited to any great extent, and in two places only, about a mile apart, were they proved as tin-bearing; at the same time, that ore has been traced from the southern extremity of the "red face" down the hill into the Don Company's workings, where this wash disappears beneath the basalts already referred to. Its probable continuation has been rediscovered at the western side of the Waratah Falls, at the bottom and underneath of the same basaltic sheets. And here their character and age has been clearly demonstrated by the occurrence of abundant fossilised leaves, &c. in the clays superincumbent on the Pliocene drifts and below the basalts. This stanniferous deposit therefore deserves attention, as it can be wrought at moderate expense.

Overlying the Pliocene drifts, especially where the bed-rock (Silurian) approaches or crops to the surface, the line of the former is indicated by a more or less extensive porphyritic boulder drift in which tin ore occurs also, right from the "red face" to the Don Company's workings.

A concise description of the various mineral and metalliferous deposits proved to exist on the several mining companies' leaseholds may not be altogether uninteresting, as by that means the capabilities of the whole region as a metal-producing district will be demonstrated.

The Mount Bischoff Tin Mining Company, Registered, are engaged in working the red face and white face principally; at a depth of 33 feet below their present working level, that deposit appears to have contracted at least on two sides, and, apparently, the width of the red face at the upper level of 1000 feet does not extend to that distance at that additional depth. At the same time, there is at the working level years of work in sight. The tin ore occurs at the 33 feet level, either in pure granular deposits or intermixed with a great deal of pyrites, which are slowly decomposing on contact with the air, causing meanwhile a rise in the temperature and the production of, by

efflorescence, mineral salts of a light green colour and very acrid in taste. It would appear as if, in future, the ore would occur chiefly with pyrites at greater depths in the "vent." Besides this enormous ore deposit, 86 feet in height at the "face," this company has proved a lode of lead ore,—galena, with sphalerite,—and three or four lodes containing tin ore, all of which have been delineated on the geological sketch plan.

The Stanhope Tin Mining Company, Limited, leases are situate immediately east, and, consequently, have had a portion of the surface deposit, and, at greater depth probably, a portion of the continuation of the red face adjoining. In this case it is quite possible that the close contiguity of the "vent" has caused the adjacent strata to be impregnated also with tin ores. North of the crests formed by the porphyritic outcrops, and for a considerable distance down towards the Waratah river, an aggregation of lodes and veins occur in conjunction with eurites, as underlaying towards the south south east. The peculiarity of this occurrence in so limited an area consists, however, in the increasing angle of the lodes in question in their underlay from near the mouth of their main adit to the crested outcrops of eurite mentioned above, suggesting the existence of a central factor of activity in the shape of a "vent," as already described, as possible, and not otherwise capable of explanation. All the various metals shown on the plan occur in the ores contained in these lodes. At present, however, the company are successfully employed in the working of and the extraction from two principal tin lodes, for which they have driven a main adit and sunk a main winding shaft in order to facilitate operations. In that adit, 910 feet in length, several veins of lead ore were intersected, and, besides, the country rocks were largely impregnated for a width of about 30 feet. Assays of this ore gave as high as 80 per cent. of lead and 98 ounces of silver to the ton. Copper in its native state and ore were found to have impregnated the country nearly 100 feet in width. Another zone of tinstone, also of nearly the same width, has been followed to about 130 feet from the surface. The main and other lodes of tin ore have been opened up to that depth and for a length of over 740 feet, where, at a depth of 100 feet, it (the zone) passes into the Mount Bischoff and *ci-devant* North Valley companies' leaseholds. The underlay varies as considerably as the width of the other lodes and of the better defined main lode also, viz., from 15 degrees to 60 and 70 degrees from the horizon. Occasionally "floors" of iron pyrites obstruct the regular course of these tin lodes; but as these pyrites contain also tin, no serious difficulties have, so far, interfered with the increasing production of tin ores. This increase must be attributed to the systematic opening of the ground in blocks, thus allowing the mines to be wrought with expedition and economy.

The West Bischoff Tin Mining Company, Registered, have, at some considerable expense, tested their ground in a most systematic manner, and besides two lodes containing "stilbites" (sulphide of antimony), they have discovered three lodes carrying tinstone. Of these, that near their eastern boundary has been given most attention, and as it extends for a considerable distance right into the late North Valley Company's ground, it forms the most regular lode on Mount Bischoff, the only drawback being its low percentage and inconsiderable width. About 35 chains in length have been exploited on its course for an average width of 12 inches only. Even with the great height of backs made available, of 250 feet, the present market price of tin precludes any reasonable hope to make a profit unless it is worked at less expense by a party of tributors.

The Don Tin Mining Company, Registered, hold a lease at the southern base of Mount Bischoff; and this proprietary appears to have found the "head" of a deep lead filled in the deeper parts with pliocene drifts containing tin ore; the more shallow portions are, of course, of a more recent age, and they comprise beds of clay (indurated) of which one in particular was observed to be composed principally of decomposed chlorite. All these beds, from the surface to the bottom, have been wrought for tin ore with more or less success, and, at the present moment, when the deep shaft workings have temporarily been abandoned on account of a too heavy influx of water, some tribute parties are obtaining a fine coarse sample of ore in or under the porphyritic boulder wash towards the Mount Bischoff T. M. Company's properties.

The North Valley Tin Mining Company had just disposed of their leases and plant to the Mount Bischoff T. M. Company, and it is only now necessary to remark that the former proprietary had done a great deal of work on the continuation of the West Bischoff lode and on a second lode parallel to the former. The whole country is very much mineralised by acidic and sulphuretted substances, comprising large blocks of green, white, and violet-coloured fluorspars and chiefly iron and arsenical pyrites embedded in steatites and quartz. A small percentage of tin ore was found to be present, but at that depth the prospects were not very encouraging. Here, as in the Stanhope Company's mines, the vein-matter is frequently displaced by floors of solid iron pyrites, converted at the surface through decomposition into outcrops of "gossan," which carry tin ore in small percentages.

G. THUREAU, F.G.S.

THE PENGUIN MINING DISTRICT.

This locality was again examined, and as all the mines were not in work, the additional information since my last inspection three years ago was kindly placed at my disposal by the Messrs. Clarke, Sullock, and Dale.

The Neptune S. L. Company had sunk a main shaft 50 feet deep, and at 75 feet east, in a cross-cut, they intersected a most promising lode formation yielding antimonial silver (dyscrasite) of good percentage. This lode was about 30 inches in width.

At the old silver mine fahl (argentiferous tetrahedrite) ores had been also met with, and a promising belt of lead ore was indicated at low level of the sea.

The Watcombe Copper Mine had been further exploited from two shafts sunk on the track of that lode, but the iron pyrites, on decomposition, gave but few indications of copper by stains. In contact with the adjacent beds of conglomerated rock the ore is more apparent, and occurs likewise as native copper in filagree blades, specks, and wires.

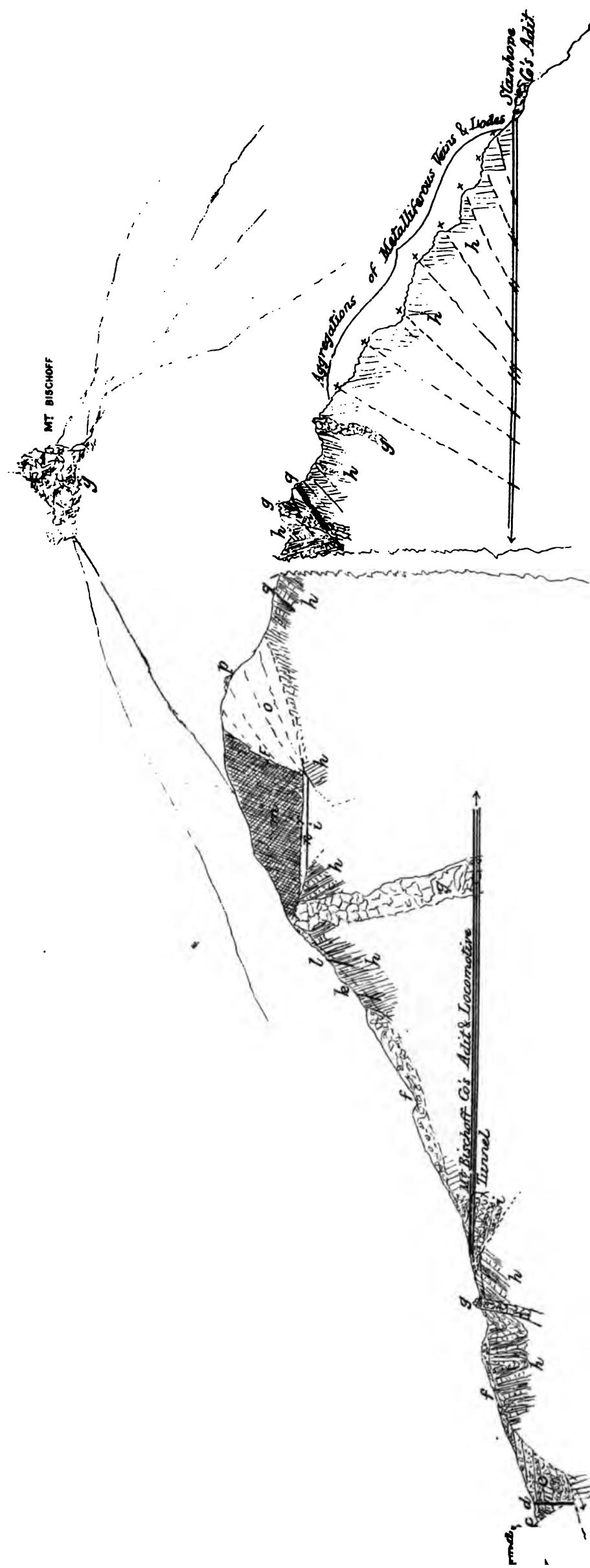
On another belt of metalliferous country, and more inland, the Devon Consols Company have sunk to a depth of 50 feet, but the influx of water made the examination of some heavy black mineral impossible for the time being. A tunnel was also driven along the course of this cupriferous and argentiferous formation for a distance of 75 feet, which disclosed blue carbonates of copper on several occasions at the footwall of this lode.

The whole region has been from time to time prospected and worked at great expense, chiefly to the inhabitants of that part of the coast; and as such praiseworthy efforts have been made periodically without obtaining actual proof of the value of these ore deposits at greater depths owing to the great influx of water at, comparatively speaking, shallow depths below sea-level, the No. 2 diamond drill should be obtained from the Government for the purpose of putting down systematically a series of bores, with a view of finally testing the promising indications already met with. I may presume so far as to recommend the Government to sink these bores at a reduced rate of charges, as the enterprise shown by these parties really deserves some such recognition at the hands of the authorities.

G. THUREAU, F.G.S.



Post G. Bureau S.G.S.
1864.



a. Upper Basalt b. Scoria and volcanic ash c. Lower Basalt d. Shaft (Don G) e. Piccav. dross f. Porphyritic boulder itis g. Dykes of euritic nephrite h. Metamorphic and silurian schists (much contorted) i. Deep and unexploited deposits k. Galena lode l. Tin lode m. Worked ground n. 33 feet level o. Unworked ground p. Outcrop of green gneiss q. Tin lodes r. Working level to "red face f"

N







SUPPLEMENTARY Report on the Mersey Coal Deposits, with reference to further Tests by means of boring through the Carbonaceous Strata with the No. 1 Diamond Drill.

Launceston, December, 1884.

As a preliminary, it may be stated that the opinion I have arrived at as to the probable existence of deep carbonaceous strata in which other seams of coal may exist, has been formed after a close examination of the district, its quarries and mines.

The fact that Mr. Gould, F.G.S., had also examined this locality, as well as other scientists, over fifteen years ago, and the maps these gentlemen constructed, have had no bearing on my labours, and, in point of fact, their reports were scarcely seen by me. It must be allowed that during the fifteen to twenty years that have elapsed since their inspections, when it was possible only to examine the surface and a very few mines, considerable changes have taken place, placing their successor in a better position to form a more recent opinion as to the prospects of these deposits ; at the same time it is likewise submitted that as science progresses an opinion formed upon limited means years ago ought not to be accepted as perennial.

For convenience of description, and also on account of supplying the important additional information obtained by means of the bore of the diamond drill, I would most respectfully draw attention to the sketch of a geological cross section from the Don River to the east of the Mersey River herewith presented.

As the question of deep carbonaceous strata undoubtedly centres on the limestones, and as it will be remembered that in my Report, No. 61, 1883, I stated that—"From all appearances the Coal Measures rest on this limestone in parts, or, where it is wanting, on the still older Silurian and Metamorphic Schists," it has been proved by means of the diamond drill that not only was this substantially a correct view, but, what is more important still, the bore has proved the "dip" of that limestone to the east, as laid down on the geological sketch plan of that Report. This enables one to draw conclusions, having, very probably, important bearings upon the question at issue.

From the outcrop of these Don limestones to the mouth of the borehole is about three miles, the level of the surface placing the latter about 30 feet lower, and, as the diamond drill cut the limestone at a depth of more than 380 feet, a dip of about 20 degrees is established. We have, therefore, tested new country beneath the seam hitherto wrought to a depth of 320 feet, without encountering any other seam or seams of coal. The country, therefore, above A on the sketch, may be assumed as sufficiently tested, and *non-coalbearing*, rendering any other efforts at similar depths of bores futile. So far as I could judge from the bores submitted by Mr. Belstead, Commissioner of Mines, for my inspection, the lower strata, though more conglomeratic in character, still maintained its general lithological appearance.

It now remains only to study the question as to the probable prospects of the field as from beneath the bottom of this bore-hole, and to deduce such facts as are possible under the circumstances. The dip of the limestone at 20 degrees east still continuing in that, or rather a little more southerly

direction, renders it quite possible—as the nearest Silurian, I am credibly informed, occurs only at or near Port Sorell (at a northern extension of that rock near Elizabeth Town)—that for several miles no obstruction will arise causing the limestones to alter their angle of inclination. And as these limestones form, by every appearance, the base of the carbonaceous beds, it is certainly a point of great interest, having a very important bearing upon this question, to ascertain, by means of the diamond drill, the mineralogical character of the strata overlying, and resting upon, the limestones *beneath* the bottom of the first bore-hole, because really that part is at present *terra incognita* and deserves to be thoroughly tested by means of other bore-holes, before it can be positively stated that other coal does not exist in this locality. It should be borne in mind that, in coal countries, frequently over a thousand feet intervene between the actual coal-carrying systems of seams, vertically; and, taking a large view of all the facts examined in that locality, I was induced to recommend the Government to sink one or more bores additional before the drill should leave the district.

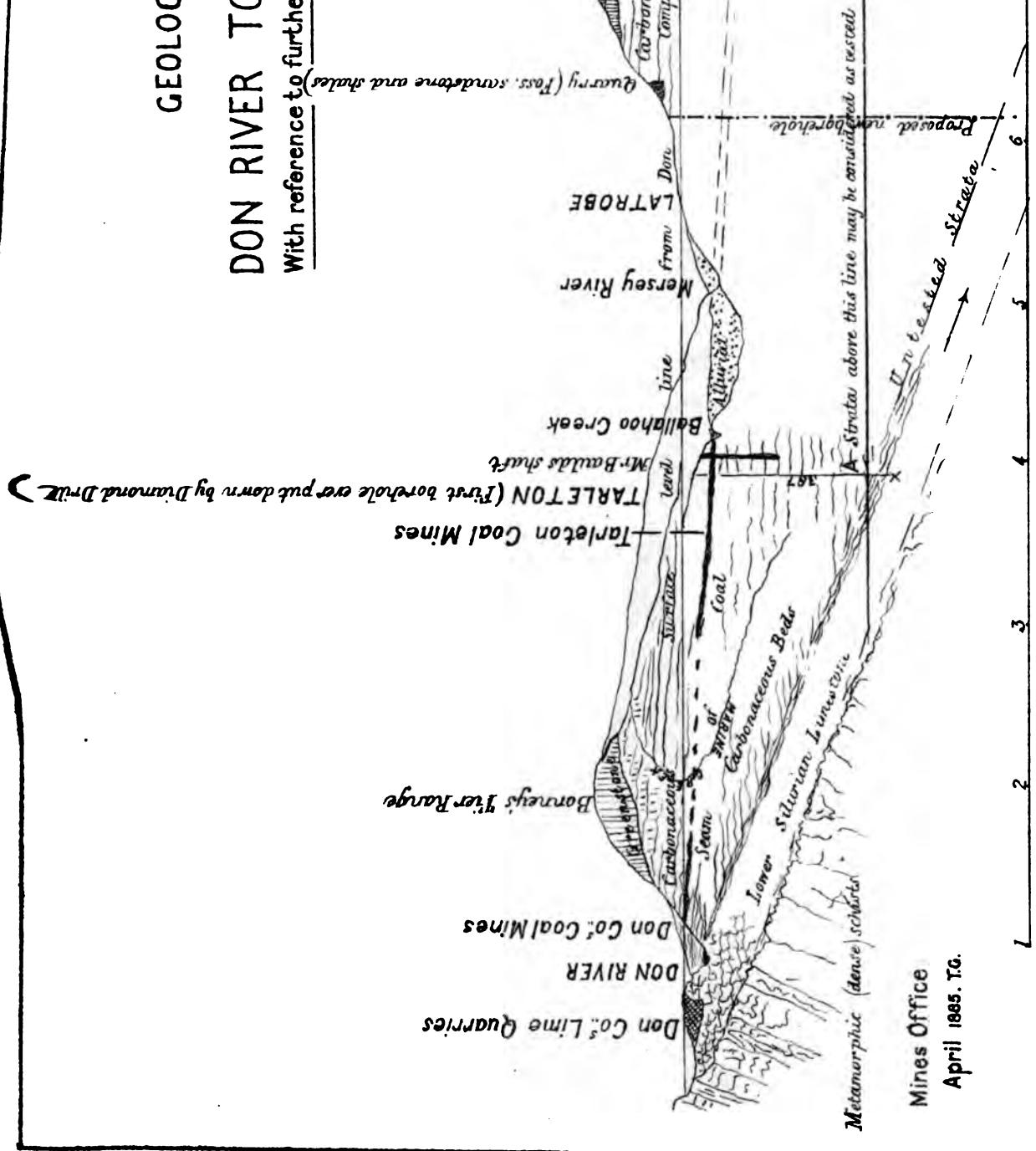
In conclusion, I might be permitted to observe that should another bore be put down, as indicated on the sketch, it could be done close to water's edge, and not many yards from where the machinery is at present stored, thus reducing the cost of transport to a minimum, whilst, at the same time, it would settle the question of the probable existence of deeper seams of coal for good.

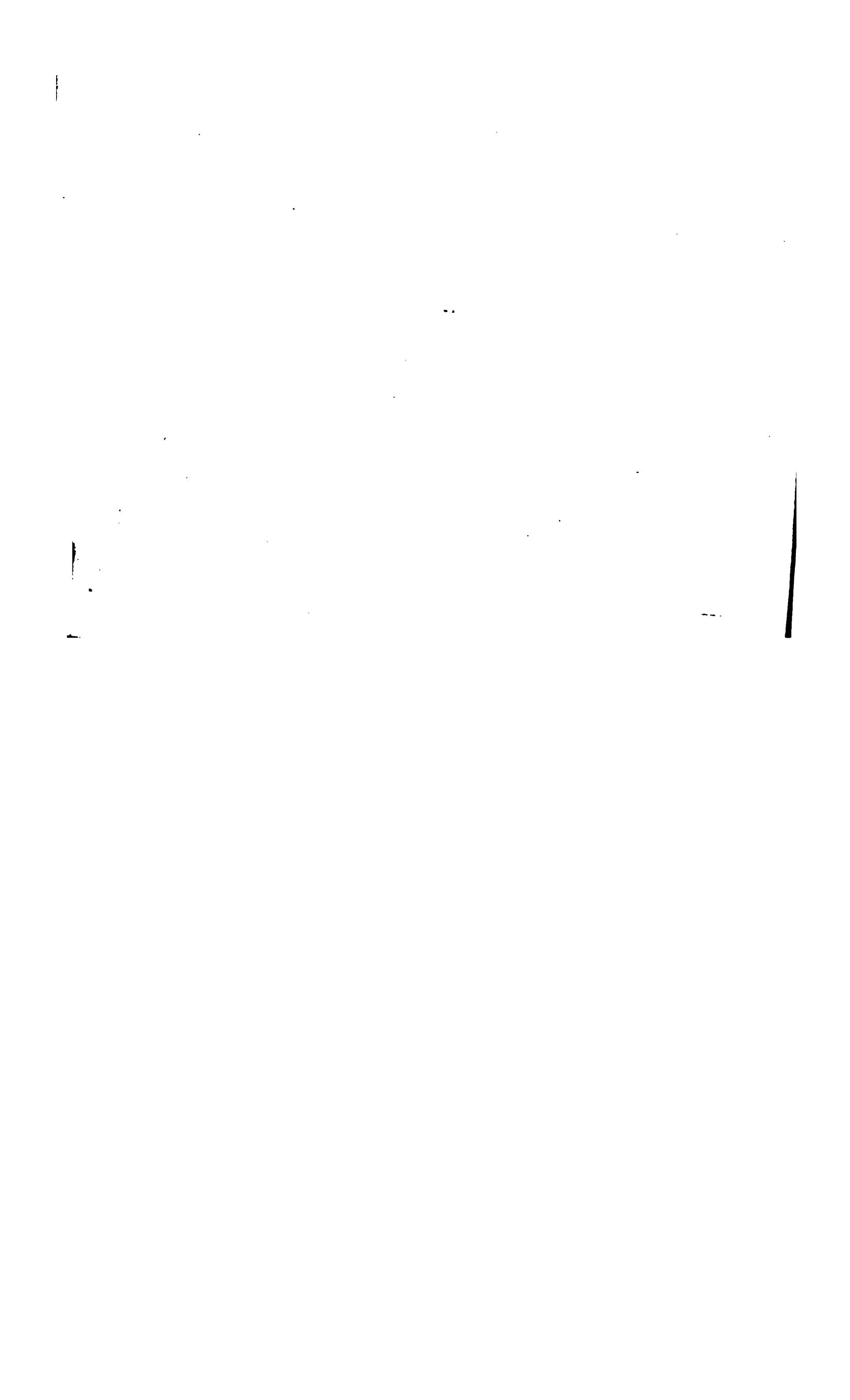
G. THUREAU, F.G.S.

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100

SKETCH
of a
GEOLOGICAL CROSS SECTION
from the
DON RIVER TO EAST OF MERSEY RIVER
With reference to further tests by means of the Diamond Drill (No. 1)

G. Murray F.G.S.





(No. 61.)



1885.

PARLIAMENT OF TASMANIA.

**MOUNT VICTORIA, DAN RIVULET, BLACK
BOY, AND MANGANA GOLD FIELDS.**

REPORT BY G. THUREAU, ESQ., F.G.S.

Presented to both Houses of Parliament by His Excellency's Command.



REPORT on the Mount Victoria, Dan Rivulet, Black Boy, and Mangana Gold Fields; also remarks after examination of the Tullochgorum Prospecting Area.

Launceston, December, 1884.

THE Mount Victoria Gold Field proper, it will be remembered, has been reported on previously, viz., in March and November, 1883, so that it is unnecessary to go over as much of the same ground again on this occasion, but now to draw attention principally to matters which appear to have not only retarded the development, but also to have caused the cessation of active mining operations in many of the leaseholds. A sketch plan is furnished herewith showing the leases, the locations of the auriferous reefs, tunnels, and shafts on the more prominent mining properties.

1.—GEOLOGICAL FEATURES.

Since my last visit a considerable amount of work has been carried out on several sections; crushing machinery has likewise been erected on three claims, races cut for supplying the water-motors employed, shafts sunk, adits driven, and a considerable quantity of stone has been raised and crushed from the levels in the various mines, thus enabling me to report more fully, from the additional information now available, at the present time.

The principal mines are situate on the east side of the Dorset River, with the exception of Loane's reef, which crops out on the west bank, due to the windings in the course of that river. The auriferous belt of country at the northern end of the field is about half a mile in width, and the nearest granitoid rocks occur about five miles from the schists in the west and about three miles in the east. This appears to be about the same distance in the south between Mounts Victoria and Saddleback, though, at the former, the carbonaceous formation overlies the Silurian slates and sandstones enclosing the gold-bearing matrices. This line of country may be, with a few interruptions, traced from the Waterhouse Gold Field through Mount Horror, Branxholm, Mount Victoria, Dan's Rivulet, Black Boy, and Mangana; and the Silurian rocks, interspersed with quartz veins, were observed in the Esk valley, at some distance from the Tullochgorum Company's scene of prospecting operations for gold in the alluvial. It will be admitted that these auriferous deposits are, at present, the most extensive we have in Tasmania, and that therefore all impediments to their general development should be removed by every means that can be used for the purpose.

The topography of the whole district is rough and broken, some of the valleys and gorges being over 1000 feet deep, as gouged out of the sides of the mountainous ranges.

At Mount Victoria, *i.e.*, from Everett's leases in the south east, near the sources of the Dorset, to the Crown Prince Company's mine in the north west, below Alberton, the gold-bearing quartz, mined at several places, is of a very *dense* and hard description; it is also mineralised to a considerable degree by those sulphides so generally found in auriferous quartz, and by the hydrates formed after the decomposition of these sulphides. The former comprise the following:—Sphalerite (zinc blonde), galenite (lead sulphide), iron and arsenical pyrites, also pyrrhotine, and, of the latter class, arsenates of iron or "pharmacosiderite." These auriferous sulphurets form, therefore, important ingredients of the matrices, besides which the gold itself, as disseminated throughout the veinstones (more or less) is of mostly a very fine description, approaching a moderately coarse grain only.

The quartz reefs that have been worked for gold may be, for the purposes of this report, divided into three groups, and with nearly the whole of them it has been observed that the "makes" or "pipes" of gold-bearing quartz on the various lodes *dip* north in the strike of the latter, the Loane's, probably, forming the exception, as it is dipping south. Then we have the Northern, Middle, and Southern Groups, each of which is represented by the following more prominent proprietaries; viz.—

The Northern Group.

The Premier, Gumsucker, Strahan, Endeavour, Mount Victoria United, and Crown Prince.

The Middle Group.

The Mercury, Wilson, Caxton, Montana, and Mount Victoria.

The Southern Group.

The Loane's and Everett's.

With regard to the Northern Group it may be stated that all the Companies enumerated have discovered gold-bearing lodes, and that they have opened same more or less. Crushings have been had from most of the veins, yielding from a few pennyweights to over an ounce of retorted gold per ton. The Premier Company have been operating on a mass of brecciated quartz occurring in hard, regularly stratified country; and in their two adits the Gumsucker, Nos. 2, 3, 4, and the easterly veins, have been intersected. Had the tunnel been continued the Strahan lode would also have been found. It appears that all these auriferous veinstones have been opened up more or less, and stone above the adit has been taken out for crushing to the surface. Owing to the, comparatively speaking, short distances driven along the course of the quartz, the ground cannot be said to have been thoroughly tested for its value. The original surface block, for instance, which was 2 feet wide, and showed gold freely, was found to dip north; and it is rather an important matter, favouring future amalgamation of these claims, that the main tunnel has passed *beneath* this block of stone, and that that adit has not yet been connected with the surface workings, as it should have been.

The Strahan Company's shaft is 70 feet deep, and at 40 feet from the surface the stone crushed first gave nearly an ounce of gold per ton; a second parcel yielded over an ounce; the only drawback being the expenses attached to transporting the quartz to the Premier battery. This reef is from 6 to 18 inches in thickness.

The Endeavour Company's reef, 10 inches wide, has been traced to a depth of only 35 feet, and a crushing averaged 18 dwts. per ton. Close by, on one of the Victoria United Company's sections, a very promising lode, 2 feet wide, crops to the surface. It is of a laminated character, and strongly impregnated with auriferous pyrites. A short tunnel and a shallow shaft, not yet connected with each other, is all the work done here.

The Crown Prince Company's mine, located farther to the east, has been opened at the surface across the old Black Boy track. Of the quartz sent down for crushing, 108 tons gave close upon 18 dwts. of retorted gold per ton, from a reef averaging two feet six inches in width. At a depth of 79 feet water came in, and a "splice" of poor quartz for a time displaced the richer shoot of stone, inducing the Company to start a main deep adit lower down the range, by means of which they can command about 175 feet of backs. At a distance of 401 feet 6 inches the lode was again intersected in the deep adit, where it is well defined and over six feet wide, the quartz being of the usual laminated description, carrying besides a little gold, a good per-cent of valuable sulphurets. A great drawback to the reefs at Mount Victoria turning out more remunerative than what they have done, consists in the hard country rocks which enclose the former, which renders mining rather expensive. The Crown Prince reef at the adit level occurs as accompanied by a soft selvage or "dig," by means of which the working of this reef will be much facilitated, at a considerable reduction of the expenses. Besides this so very similar feature in comparison with the deep Sandhurst (Victoria) quartz reef, another and equally satisfactory circumstance was observed (so far as I know, the first instance of the kind in Tasmania), namely, the occurrence of a "dyke" of volcanic rock intersecting the schists. This dyke was found 300 feet "in" from the mouth of the adit, bearing S. 52° W. for a width of over 2 feet, and was accompanied by strings of quartz embedded in soft black slate. It runs nearly parallel to the course of the reef itself, 101 feet 6 inches farther along in the tunnel. Although not possessed of any direct influence or bearing upon the occurrence and value of quartz reefs, these dykes of "*anamesite lava*" are yet regarded with very considerable favour by the practical miners of Sandhurst, as in their experience they afford excellent indications for the periodical "recurrence" of their rich quartz lodes at ever increasing depths (to 1920 feet); and this discovery of a dyke of a variety of "*Gabbro*," or better known as "*Aphanite*," in conjunction with the Mount Victoria reefs, is likely to be fraught with considerable importance as affecting their future permanency to great depths, especially so if other similar dykes are found to exist.

Glancing at the sketch plan it will be found that this northern group (like the two other groups) forms quite a cluster of proved auriferous veinstones, the outcrops of which are located at various and considerable altitudes above the Premier Company's batteries. As nothing appears to be known of the metalliferous character, if any, of the country situated between the most westerly (Malunna) reef and that crushing plant, it would seem a matter for future consideration whether or not a central deep adit could not be driven in order to prospect by that means the unproved country, and, at the same time, intersect *all* the known veins and lodes at a much greater depth, whereby most of the expenditure for trucking upon costly tramways and down inclines would be avoided. If, for instance, all those companies were to amalgamate upon a certain equitable basis from "below" this deep adit level, and meanwhile create a kind of reserve fund of proportional contributions towards the driving of that adit, all these reefs could undoubtedly be wrought much more economically, and, for a very considerable time to come, the batteries would be more fully employed than is now the case, whilst the expenses for driving that main adit would not be felt very much by the contributing proprietaries.

The Middle Group

Comprises the Mercury, Wilson, Caxton, Montana, and Mount Victoria.

The first-named, owing to the discovery of two parallel lodes of good width, early attracted attention, and, as the stone very frequently exhibited rich gold pretty regularly disseminated through it, it was hoped that that company would give a good account of itself when in full operation. Two tunnels were driven, and each lode intersected; and as shafts had been sunk following their underlay from the surface connecting with those adits, regular stoping above the adit levels should have followed as a matter of course. During my careful examination of the whole of the workings it was found, however, that the working of the mines had been carried on very unsystematically and without any regard as to the future. Nature itself having favoured this metalliferous region in the way of facilities for deep tunnelling instead of deep main shafts, and, if properly conserved, of sufficient water power for driving the crushing plants, the working expenses of most of these mines should have been much less than where steam power would be required for hoisting, pumping, and crushing; but, generally speaking, no such reduction has taken place, and the working expenses of the mines, and of the manipulation of the ores raised, are still above what practical men anticipated. In the Mercury Company's mine the adit on No. 2 reef commands 125 feet of "backs," and on No. 1 reef, 92 feet. These stopes of ground, with the average width of the veinstone, should have kept the batteries going for a considerable time had the levels been kept *ahead* of such stopes. This, however, had not been done, and, in order to obtain supplies for the batteries, underhand stoping and other means were resorted to, which not only added to the expenses, but eventually brought the mine to a standstill; besides which, the quartz having been taken indiscriminately and mixed up with much non-auriferous rock, with a view only of keeping the batteries going, the yield per ton* was much reduced, and, therefore, became unprofitable to work. A change in the management has, however, taken place, and the mine has been put into a pretty good state, although many feet had to be driven on both lodes before stoping could again be resumed with regularity; and it is hoped that by blending the richer with the poorer quartz, and by exclusion of all valueless wall-rock, the yield will become higher than what it has been lately. The two lodes, 229 feet apart, run nearly parallel to each other, and they are nearly vertical, viz., one foot in 14 feet for underlay, and, as the ground is hard, require not much timber except in the levels, which should always be kept well ahead of the stopes.

The Wilson Company, Pollentine's shaft, has been sunk on the underlay of that lode which Mr. Wilson originally discovered. At the side of Wilson's Creek, below the outcrop, there appear two veins of quartz which *diverge* in their underlay to the east and west, but they, at the same time, in their northern dip, in the general strike of the lode, *converge*, thus forming a "saddle" reef, so well known at Bendigo (Victoria.) The two separate bodies of stone forming the east and west "legs," as descending from their "saddle," are of a seamy character, the western being the larger of the two, and it contains more gold than that in the east. As the latter could only be worked from the creek level, the other, or western, lower down that creek, would command some 20 or 30 feet of more backs, which in itself would be a consideration, as the stone of the west leg could be followed farther than the eastern leg, owing to the rather rapid dip to the north, and because the cap of the lode, or the junction of the two legs, had proved, so far, of little or no value.

In this connection it may likewise be stated that the No. 2 lode in the adjoining Caxton Company's ground—a very fine solid gold-bearing body—occurs precisely in the centre between those two legs, thus exhibiting, owing to its northerly dip, a much lower body of auriferous quartz than that met with in the Pollentine's shaft, which it underlies in the form of, probably, a second and deeper "saddle." As from all appearances this will be found to be the case, it establishes, in my opinion, a very valuable feature on this goldfield which cannot but have an important bearing on the future permanency of the whole of this auriferous region. As will be seen from the sketch plan, the reefs at Mount Victoria observe the reverse of regularity in their mode of occurrence and

*1689 tons of quartz were crushed for 1453.15 ozs. of gold, or, on the average, 17 dwts. 5 grs. per ton of retorted gold.

of their bearings towards the horizon ; in fact, the whole of these veins are disjointed, strike almost at any angle, and are therefore rather difficult to follow. The country, as well as the Wilson and No. 2 Caxton* reefs, are much more regular, and of a "kindlier," so to speak, character. It thus appears that when the Mercury, and eventually the Premier group, approaches at considerable depths these underlying formations, those lodes at deeper levels will also become more regular and continuous than what they are at present.

The No. 1 Caxton lode has been followed from its outcrop at the surface, rather high up the range, by means of a tunnel, for a distance of about 200 feet. A very regular wall accompanies the stone, which latter occurs in bunches or shoots, the average width being from 18 inches to 2 feet, giving an average of 10 dwts. 9 grs. per ton.† An air shaft was sunk 180 feet from the mouth of the adit, which requires about 50 feet more before it will connect with the adit. It appears that before many feet had been driven on this lode, and previous to any positive knowledge of the value of the lode had been arrived at, a sinuous tramway was constructed for a length of over 75 chains, at a cost of £375, which connects the mine by means of a shoot with the Mercury crushing plant of ten heads, the other five heads belonging to the Caxton Company. From present appearances it will be some time before sufficient "backs" can be made available for crushing regularly, and meanwhile the tramway requires alteration and repair. It will also be judicious to drive on the lode at the tramway level, as the shoot is not in a very good working condition.

The Montana Company have started to drive on what appears the continuation of the No. 1 Caxton lode, inside the Mount Victoria Company's ground, or 167 feet from the Montana Company's southern boundary, the tunnel having been continued in their own ground 50 feet farther and still driving. At 90 feet "in" a "fault" occurred, displacing the lode which had been found in the mouth of this adit ; and in that distance the width varies from 6 inches to 3 feet in the stopes. As from the rise of the range every foot driven adds to the height of "backs," the tunnel should be continued for that reason alone, if not for the probability of larger and richer bodies of stone being discovered along the strike of this lode. At the end of the adit there were about 3 feet of vein-matter taken for crushing ; the remaining 12 feet, although sometimes interspersed with gold-bearing quartz veins and threads, was found too poor to remunerate for all expenses incurred. A surface air-shaft was anticipated to be soon connected with this adit ; and it should be observed that in all this Middle Group the auriferous shoots of stone dip to the north.

The Mount Victoria G. M. Co. have wrought the reef Mr. Balstrup discovered by means of a large boulder of auriferous quartz which had become detached from the reef and washed down a gully, both by shafts and an adit connecting the same. This upper tunnel is 157 feet in length, and a cross-cut to the west of 31 feet intersected the lode, on which 139 feet have been driven. At the south-western end a "slide" or fault has temporarily displaced the lode, and a great deal of stoping has been done right to the surface. The lode averages 18 inches in width, and underlies 18 inches in 3 feet. So far, 1940 tons of quartz have been crushed for a total yield of 1748 ozs. of retorted gold, making an average of 17 dwts. 12 $\frac{1}{2}$ grs. per ton. In this mine, as in most of those of this Middle Group, good gold-bearing quartz has been found at the greatest depths attained, and the prospects for remunerative and profitable work at these greater depths are very good. This Company, in order to avoid the present heavy expenditure for carting the quartz from the shoots to their battery, have driven a deep main adit, No. 2, which would give them, if continued, over 95 feet of backs beneath their No. 1 or first adit. This main adit is a creditable piece of work, very straight, and, like all the other mines, well secured with sound timber.

The Southern Group.

The Loane's Gold Mining Company's reef is situated on the west side of the Dorset, and it crops to the surface 26 feet above the river, underlying to the west, with the shoot of stone dipping south. A vertical shaft was sunk to a depth of 47 feet, and at 45 feet the lode was driven on for 20 feet, showing a mixture of gold-bearing matrix and pure quartz also. The surrounding strata is, like the reef itself, very dense and hard ; the quartz has that peculiar bluish hue due to the pyrites occurring, principally in the laminations. Gold was seen in the latter as well as in the solid quartz, which appears to be of about the average character on this goldfield. They were much incommoded by the water, which is not surprising, as the southern continuation of the lode must cross the Dorset a little higher up, thereby increasing, by percolation, the influx of water. An adit started at high-water mark from that point along the course of the reef would have been an easier and less expensive method for both proving this reef and for raising stone for a trial crushing.

The Everett's Gold Mining Company have disclosed, by means of open cuttings and shafts two very massive formations of quartz reefs. Both are highly mineralised, and the sulphide of zinc is here more prevalent than elsewhere on the field. The eastern body averages about three feet in width, and the western occurs in bunches from five to nine feet in thickness, besides which the adjacent wall-rocks are interlaced by veins, spurs, and strings of quartz. Gold has been found in both reefs, but, so far, trial crushings have not, the same as on the Loane's reef, yet been made.

* Marked A on the Plan. † 202 $\frac{1}{2}$ tons yielded 157.27 ozs. of retorted gold.

From the above description it will be seen that the Mount Victoria Gold Field, embracing the three groups, still maintains a high character. There is abundance of payable quartz obtainable if only *systematically* and *conjointly* worked. So far as could be learned, not one of the reefs had been followed along its course to more than 150 feet, and the greatest depth is under 200 feet, which appears insignificant when compared with other quartz mining districts, especially as it is well known that very good stone has gone under foot at some of the deeper levels. Having obtained the yields above referred to, there is actually no evidence of the yield of gold per ton that *should* have been got, considering the modes of extraction adopted and the style of appliances in use by nearly all those companies who have erected crushing plants.

2.—PRESENT TREATMENT OF ORE AT MOUNT VICTORIA.

The Premier and Mercury Companies employ waterwheels of large size as motors, whilst the Mount Victoria Company uses a portable steam engine for that purpose. The first named proprietary crush by means of ten heads at a speed of from 75 to 78 blows per minute. The crushed sands pass through gratings having 200 holes per square inch, and at each set of tables, besides the mercury ripples, two copper plates electro-plated with coin silver, and which are afterwards charged in the usual way with quicksilver—on the Californian plan—are used for amalgamation. Blanket stakes follow, and the whole process of intercepting the fine gold terminates with the two sets of Cornish “ties.” The battery manager, one of the oldest and most experienced in Tasmania, declares that those copper plates are very excellent for amalgamation outside the boxes, and that there is no question as to their superiority over the common copper plates. This battery, &c. was found in good working order, clean, and evidently well looked after.

The Mercury Company have fifteen heads, of which, however, five are owned by the Caxton Company; the speed of the camshaft gives but 65 blows for each head per minute, and their gratings are pierced for 200 holes per square inch. Common copper plates, charged with mercury, and the requisite number of ripples to each of the three tables are used, and the crushed material from each table passes over blanket stakes, from which it falls into a channel (launder) in which it is conveyed to a Berdan basin (one for each battery) for trituration with quicksilver in order to produce amalgamation of any gold thereby liberated.

The Mount Victoria Company employ steam for working their crushing plant of eighteen heads, *i.e.* six heads in each box; their gratings have 225 holes to the square inch. The ripple tables are lined, each with four common copper plates, and they have also the usual number of mercury ripples for each table. The blanket stakes are 21 feet in length, and the blanket sands are regularly gathered and stored for future manipulation.

It will be seen that, without the Californian electro-plated silver copper plates, the whole of the processes of collecting the gold from the crushed matrices are such as has been used for many years back with quartz-crushing; indeed, in one instance, a machine was permitted to be operated as could not but result in loss. At the Mercury Company's plant crushing was carried on at a low rate of speed, thus inducing loss of gold, as experience has taught battery managers; besides that, the plant was found in a dirty state, with grease and oil dropping everywhere; especially was this found to be the case with the bearings and the cams of the camshaft, and thus greasy matter was seen on the boxes and the splashboards at the head of the tables. Then, again, the Berdan basins were set up at too low an angle to allow them full effect in grinding and amalgamating. That this state of affairs, so easily prevented by a little more care and attention by the person in charge, was productive of a loss of both gold and quicksilver I make no doubt, and that opinion was fully borne out by the fact that tailings or waste taken from the creek some 40 feet outside, or away from the battery house, yielded to the pan, in my presence, about 1½ lbs. of valuable pyrites, and several largish globules of mercury evidently charged with some amalgamated gold. Under these circumstances it is really not surprising to see so promising and very valuable a mine depreciated as it has been, and having so detrimental an effect on the whole goldfield or goldfields in Tasmania.

3.—SUGGESTIONS AS TO FUTURE MINING OPERATIONS AND TREATMENT OF AURIFEROUS QUARTZ.

In crushing veinstone of this character it is shown how absolutely necessary it is to have it reduced to a very fine-grained “pulp,” in order to facilitate the *mechanical* liberation of the gold contained; and it should be recollected that this class of gold is much finer and lighter, on the average, than any or the finest alluvial gold in the rivers or at the sea beaches.

The stamped veinstone, as issuing after crushing from these Mt. Victoria crushing plants, is associated with gold as follows:—

Firstly.—Free gold, capable of concentration with water, and subsequently of amalgamation with mercury.

Secondly.—Laminated and honeycombed gold, easily carried off by impure and too much water.

Thirdly.—Gold mechanically mixed with and enclosed in the coarser particles of pyrites, which require to be reduced still finer in grain to liberate the gold.

The great loss in working is in the “float” or laminated and honeycombed gold. It is difficult at this stage of operations at Mt. Victoria to determine the exact amount; but elsewhere, with similar processes, even when the utmost care is exercised, it amounts to from a sixth to a third of the gold in the ore. It has been proved that stamping is the more economical process, especially where the vein-stone requires to be finely crushed, and that pans, rollers, &c. should follow. At the same time it should be borne in mind that the more opportunity is given for the stamped ore to come into contact with the mercury the greater will be the per-cent of gold collected after amalgamation. For instance,—in California and Nevada the boxes are lined *inside* with thick strips of copper plates, electroplated with coin silver and amalgamated with mercury,—thus inducing, by means of the slightly aciduous water used in crushing—the result of stamping sulphuretted vein-stone—an electro-galvanic reaction, highly favourable to that important process of amalgamation.

Late discoveries claimed to have been made in connection with the introduction of *direct* electrical action on the stamped gold ores flowing over the tables, &c. from the boxes, or the gold gathered in the mercurial ripples, appear as yet to be in the theoretical or experimental state; though undoubtedly they, or any other method by means of which the gold now escaping can be collected, deserve every attention and encouragement.

With quartz as at Mount Victoria, of the very hardest and densest description, it is suggested that the following might be adopted with advantage; viz.—

1. Stone or ore breakers, as permitting larger quantities per head to be crushed.
2. Stampers not to have less speed than, say, 80 blows per minute.
3. Gratings with 300 holes per square inch, and all worn out boxes to be replaced by new patterns having but *one* grating frame for the whole length of the box, and the gratings to *overhang* the splash-board so as to give more splay to the water and sand in the boxes. Boxes inside to be fixed with strips of electro-plated (silver) copper plates. (See diagram *)
4. For each table with ripples to have three electro (silver) copper plates. These should be manufactured in the battery-house, as could easily be done.
5. Blanket strokes 20 feet in length.
6. Pans (revolving) or berdans, set up at an angle of 40 degrees or more.
7. Hunter's Rubbers, which machines perform three very requisite operations at very little expense of motive power, and are well adapted to the manipulation of Mount Victoria quartz. They grind the pulp finer; they concentrate the pyrites simultaneously with amalgamation of the thereby liberated gold; and they collect the greatest per-cent by any other apparatus of *float* or *floured* gold or quicksilver. (See diagram †)

If this course of treatment of auriferous quartz be adopted there will be at the several stages of the process a continuous accumulation of pyrites still impregnated with some gold, and therefore valuable. These sulphurets, it is recommended, should be carefully collected and stored, because as these mines get more developed in depth and at various levels, the time will not be far distant when these pyrites will afford employment to a local roasting furnace and subsequent grinding, or possibly the more thorough process of chlorination, for the extraction of the gold they contain.

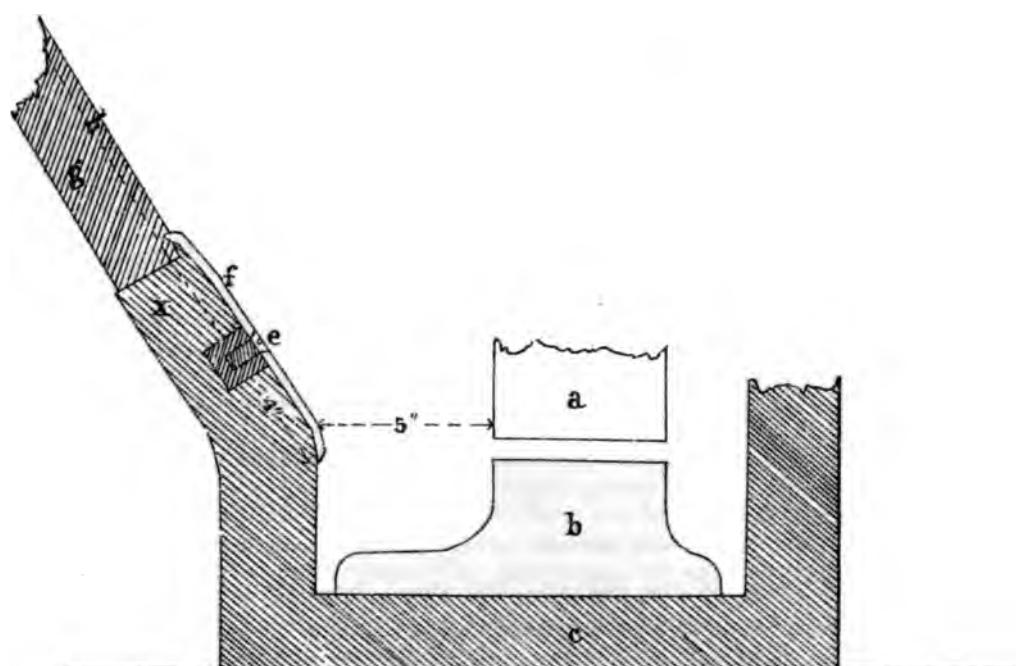
In thus advocating a more scientific treatment for the quartz in that locality I am but following up the advice I tendered to the mine-owners in my Report in March, 1883; and I am perfectly certain that had my advice been followed, this goldfield, instead of being in a languishing state, would be on the road to prosperity.

The Everett leaseholds are, so far, the most elevated in the Dorset River watershed. By following the old Black Boy track or a shorter and more recent track over the dividing range above Everett's, the head waters of the Dan Rivulet, having a fall to the South Esk River, are reached. On the former track the metamorphic schists and silurian slates, with sandstones, are, at the base of Mount Victoria proper, overlaid by fine-grained sandstones and beds of coarse conglomerates of the carbonaceous formation. A leading spur descending south to the Dan from the south south-western flank of the mount consists wholly of metamorphic schists interspersed with veins of quartz, and at about eight miles south-west from Alberton across the Dan Rivulet the Golden Point Company's leases (30A.), or “Kerrigan's Discovery,” are located. Their gold-bearing reef has been traced on

* This diagram was taken from my “Synopsis of a Report on Mining in California and Nevada, U.S.A.,” published by the Victorian Mining Department.

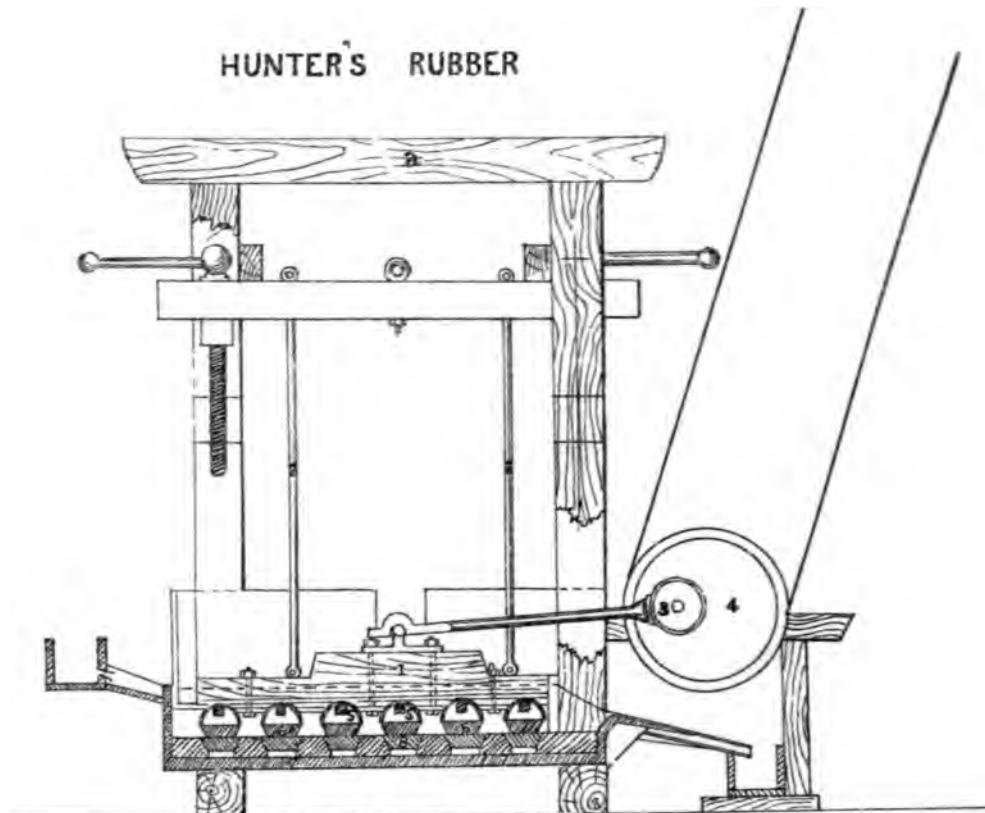
† Ditto.

ELECTRO COPPER PLATES IN BOXES



CROSS SECTION

- a Shot.
- b Die.
- c Base.
- e Hole plugged with soft wood.
- " Holes counterbunk in Copper Plate.
- f Copper Plate.
- g Gratings Frame.
- h Line for Gratings.



CROSS SECTION.

Scale : Half inch to one foot.

Hunter's Rubbers.—These machines receive the above—viz., crushed ore, which are still impregnated with a good percentage of very light or “float gold,” from the tables direct from the grinding pans, as already described, but neither steam nor chemicals are used in their manipulation. This Hunter's rubber is rather a complicated machine, combining, like most other American gold-saving appliances, two or three different actions, viz., grinding, amalgamation, and concentration. It has a similar appearance, it will be seen, as the old shaking tables, and its motion is also similar; but in detail it differs materially from the former. From the frame-work *a*, well stayed, depend two bearers (1), by means of four bars of round iron (2, 2), and these are rocked fifty-five times a minute by two eccentrics (3), and pulleys (4), with a stroke from 5 to 7 inches. Six pieces of pine wood (5.5.5.5.5.) are bolted to the bearers longitudinally, their tops being round and the bottom square, where they are armed at the bottom with the same number of shoes (6.6.6.6.6.), all these being the really movable parts of the machine. In a strong cast-iron box a false bottom is laid by means of alternate strips of wood covered with electro-copper plates and cast-iron dies, in the same longitudinal fashion, so that the shoes rub upon the dies and thereby grind the ores. At the same time the tops of the wooden strips (5) are covered also with electro-copper plates, and as they are immersed, any, in fact nearly all the float gold liberated by the grinding is collected at the apex of each cylindrical copper plate, and the pyrites are also concentrated in this box. This is a very valuable machine, as it collects from 10 to 12 per cent. of gold that would otherwise float away with the blue slimy water, which it is well known is allowed to escape elsewhere.

the surface for over 120 feet in length, and two shafts, one hundred feet apart, as well as other surface workings, disclose a fine compact body of auriferous quartz, the cap of which is strongly impregnated at the joints with ferro-manganese. The gold-bearing ore itself is of a highly mineralised description, chiefly through the occurrence, in the laminations, of the sulphides of iron, arsenic, and zinc, all of which exhibit, after decomposition, a considerable amount of free gold. This indicates that the gold will be associated at greater depths with non-decomposed sulphurets, rendering the adoption of more than the ordinary means for saving of gold necessary. The reef is 2 ft. 6 in. in width, and it produces large massive blocks of quartz; the bearings of same are S. 76° W., having an underlay to the south-west; in places, however, it is nearly vertical. The general appearances of this lode at the surface and at a depth of from 40 to 50 feet in the two shafts, where the gold is also more plentiful, is very encouraging, and nothing is now wanting but a suitable plant of crushing machinery to reimburse the owners for the outlay had and to be incurred, for without a crushing plant on the spot the mines cannot be wrought to advantage or with profit.

Proceeding down the valley to the confluence with the South Esk River, it is noticed that the western ranges are of the same geological structure, and in all probability also auriferous in parts, and they continue to be so to the southern side of that river, where the old Black Boy or Mathinna goldfield is located.

That goldfield, at one time so prosperous, is now all but abandoned; a few alluvial diggers still work and re-work the alluvial deposits which were formerly found so prolific in gold; the numerous quartz reefs in this neighbourhood are quite abandoned, and the steam-winding, pumping, and crushing machinery has been removed elsewhere. This appears to be a very anomalous state of affairs. Here there are numerous gold-bearing quartz veins and lodes which have, in the past, yielded profitable average yields of gold, without a single stamp-head being now available, whilst, but fifteen miles away at Mount Victoria, there are, at a low computation, from 15 to 20 heads hung up for want of quartz to crush, owing chiefly to the want of a proper system in providing, by means of deep adits, &c., large reserves of quartz in the stopes and workings.

In addition to the *known* vein deposits of gold-bearing quartz at Black Boy, it is very probable of other discoveries being made south of Kerrigan's discovery, so that the Mathinna goldfield promises yet to become an important mining centre, whenever the prospectors and miners are enabled to employ suitable crushing machinery at reasonable rates per ton.

It may prove interesting to recall, in this Report, the salient features of some of these gold-bearing reefs, the permanency of which has been, in one instance, proved to a depth of 670 feet from the surface—that being the greatest depth to which payable quartz has been followed in the Colony.

The City of Hobart reef (see Geological Sketch Plan) has reached the extreme depth mentioned, and this lode averaged, for a width of 3 feet, a yield of one ounce of gold per ton. There is a shaft in pretty good repair sunk to that depth, with three compartments, and the bottom cross-cut from this shaft reached the reef at a distance of one hundred feet. This lode, bearing N. 55° W., so far as could be ascertained, was never followed in its course for more than 50 feet each way from the cross-cuts, or for 100 feet altogether, thus indicating that only a single "block" of auriferous stone had been worked, and as no further prospecting had been carried on *beyond* either end of these levels, it is problematical whether or not other "blocks" similar in value exist between the walls of such lode. This has been found to be frequently the case in other quartz-mining districts, and it is certainly worth a thorough trial.

In summarising the above and the following statements it should be borne in mind that a considerable lapse of time has intervened since these mines were being worked for the supply of quartz to the crushing mills, and that since the removal of that machinery this goldfield has undoubtedly retrograded so far as population and yield of gold are concerned.

The North City reef is situated a short distance to the north-east of that of the City of Hobart. It has been tested to a depth of 100 feet, exhibiting an average width of 3 feet, for a yield of 5 dwts. of gold per ton. The bearings of same are very irregular, strongly indicating a junction with the first-mentioned lode at no great distance to the south-west. The East City reef, still farther to the north-east, occurs in soft country rocks, the yield being also about 5 dwts. per ton. These three lodes could be worked very economically from the deep main shaft, as the distances to be driven are not at all great, nor is the country rock too hard for carrying out the work contemplated at too great an expense.

The Champion reef, close by, also averaged 2 feet in width; it carried a coarser kind of gold, at the rate of 7 dwts. per ton.

The same may be said of the Prince of Wales; and quite a number of other reefs were discovered in this neighbourhood as well as to the south-east of Mathinna township, but they could never receive proper attention from the causes already described—viz., want of crushing machinery.

The Eldorado reef appears to be of a promising character. It is about 3 feet in width, and two shafts 100 feet deep each have been sunk in the ground, and an adit has been driven for a length

of 350 feet, but failing to strike the lode at that lower level caused a suspension of operations. It is now stated that if the tunnel in question had been continued for less than another 50 feet the reef would have been met with. There appears to be every inducement to do this, because, with the regular thickness of the reef and an average yield of 2 ozs. of gold per ton, it should turn out a good speculation. The last crushing of nearly 100 tons of quartz from this mine gave the satisfactory yield of 2 ozs. 17 dwts. of gold per ton.

The alluvial gold from this goldfield is of a very pure description, solid, and altogether a very excellent sample of the precious metal.

Passing on towards Fingal, 18 miles distant, it may be observed that in the broad valley of the South Esk River and the adjacent western foothills an extraordinary accumulation of recent fluvial gravels are exhibited, and that the older alluvial (pleistocene) gold drifts of the Black Boy goldfield gradually dwindle away and become too poor in gold for profitable working on their debouching from the narrower gullies and entering upon the very wide and extensive valley of the South Esk River. (See Plan at A.A.) This is only in accordance with the experiences had at other and much more extensive goldfields, where, as a rule, it has been observed that the gold is distributed through much larger and extensive beds of gravel, rendering the collection of such gold too expensive and tedious to be profitable. As the percentage of the gold in the bulk of the gravel decreases in the corresponding rates with the greater distances at which those deposits occur, from their original matrices, i.e., the quartz reefs, so depends the existence of "deep leads" or "gutters" on the closer vicinity of such auriferous quartz lodes. Of the older pliocene drifts—"lower gold drifts"—chiefly composed of waterworn quartz pebbles and boulders nothing could be observed, consequently "deep leads" in the strict sense of the words appear not to have been formed in this locality. And those contemporaneous sheets of basalt, which, in deep gold lead districts, mark the epoch and serve as a covering for those valuable deposits, are wanting to complete the evidence in favour of their existence. It is possible, however, that remnants of the "Newer Pliocene" or "Middle Gold Drifts" occur near the pleistocene (alluvial) or upper gold drifts. Judging from the great thickness of these fluvial beds of gravel, and the great extent of same in this valley, there must have been, in prehistoric times, a stupendous scour periodically, which in all probability interfered with the deposition of gold in payable quantities on the underlying bedrocks.

The Mangana goldfield is located about seven miles north north-west of Fingal township, and for that reason it occupies the most southern extremity of the auriferous belt of country which commences at Waterhouse. Originally the Mangana alluvial gold deposits have been very rich, but now they are very nearly exhausted, and the reefs in that neighbourhood have, in the past and present, had considerable attention. What has been stated of the gravels, &c. occurring in the South Esk valley is the more applicable so much lower down that principal watercourse, especially after receiving the tributaries—viz., the Break o' Day, Fingal, and Mangana creeks—as these have no doubt intensified the scour reported above. This is borne out by the fact that, for instance, the Mangana Creek, opposite the Alpine G. M. Co.'s battery, has a fall of over 400 feet to the South Esk River at Fingal, or at the rate of over 60 feet to the mile.

The Alpine G. M. Co.'s tunnel has been driven for a length of 200 feet S. 72° W. to the lode they are working, which observes a bearing of S. 22° E. The tunnel has been continued for other 225 feet beyond the reef, or 425 feet altogether. The lode averages from three to four feet in thickness, with the quartz strongly mineralised by the usual sulphurets, the yield of gold per ton ranging from half an ounce to over an ounce for such a quantity. A very marked difference was noted in the character of this auriferous quartz as compared with that obtaining farther north on the same belt of country. At Waterhouse, Mount Horror, Mount Victoria, Kerrigan's, and Mathinna the ore is found to be of a very dense description and very hard. Here it is very friable, permitting same to be mined and crushed at considerably less expense. As a matter of fact, it so much resembles the gold-bearing quartz from the deep levels at Bendigo (Sandhurst, Victoria), as to render the distinction quite perplexing. A tunnel has been driven on the boundary of the Buckland and Alpine freehold and leasehold properties, in which the Alpine reef was intersected at 200 feet from its mouth, and same was continued for other 225 feet, or 425 feet altogether. The lode was likewise passed through in an air shaft, whereby over 150 feet of backs were proved to be coneatable at this tunnel level, and as that adit is located 600 feet above the Alpine Co.'s tunnel, in which, however, that lode had not yet been cut, the preliminary workings are of an enduring and promising character. It should be mentioned in this connection that at a distance of 440 feet from the mouth of the Alpine Co.'s tunnel the No. 2 Government diamond drill was employed to bore almost horizontally, in order to ascertain the character of the ground ahead, and if possible to strike other auriferous veins. The bore was successfully, and under great difficulties, owing to the extreme density of the strata, extended to a total distance of 520 feet—the longest borehole (horizontal) in the Australias—without succeeding to strike other reefs, except of proving the extreme end in a more quartziferous country, not auriferous however, and affording very valuable information as to the description of rocks this deep adit will have to be eventually driven through.

The gold-bearing stone at the upper level dips north in its strike, and that "shoot" of stone appears to lengthen on the course of the lode. After examining these matrices in the workings I concluded that they were of a permanent character, and that they should be exploited from deep

adits, when nothing so far as could be seen would prevent these mines from being placed amongst our profitable gold mines. The topographical formation of the country near and at the mines is eminently favourable for the construction of deep tunnels.

A few remarks on the Tullochgorum prospecting area are added to this Report for the purpose of drawing attention to matters connected with gold-mining operations in that locality ; should a "deep lead" exist there it will be of very considerable importance to this Colony ; also with a view of drawing comparisons from a geological point of view between the lower gold drifts—older pliocene—so extensively worked with such splendid results in Australia and America (California) and those alleged to occur in the South Esk valley. If the deep gravels now brought to light in the cores of the diamond drill are also of that age, then the opinions of well known and prominent geologists who have carefully examined this matter, in reference to their great established commercial value of those older or lower gold drifts of the pliocene era, and the unproductiveness or non-payable character of the still older miocene, must be considerably modified.

About a mile below the junction of the Mangana Creek with the South Esk River a very considerable amount of work has been effected in order to prove the existence of a deep lead which is said to exist thereabouts. A number of boreholes were put down by manual labour, and afterwards a main shaft was sunk, equipped with steam-winding and pumping gear, through the gravel to the bedrock ; finally the Government No. 2 diamond drill was also engaged for still further testing this ground for gold. Gold has been reported to have been found in the former, but it has also been stated that the drives from the shaft failed to disclose same, and but very little gravel on the bedrock. By means of the diamond drill one bore was sunk to a depth of 253 feet, bottoming on sandstone, interspersed with veins of calcite as underlaying the higher gravel ; and preparations were just about completed for the commencement of No. 2 borehole.

The distance of this prospecting area is about five miles from the Mangana and 22 miles from the Black Boy quartz reefs, and, as these constitute presumably the sources of the supposed deep gold deposits here, it should, for instance, be remembered that at Ballarat their deep "gutters" or "leads" become so impoverished from their former so well-known *unparalleled richness* in gold within less than three miles from their auriferous matrices as to have rendered all efforts to obtain profitable or even payable results futile.*

At the goldfields mentioned in the foot-note *quartz* forms the principal and characteristic constituent of their deep gravel deposits or lower gold-drifts, in which it occurs as the base and in the form of "drifts," "pebbles," and small to large boulders, which are frequently cemented together thoroughly by ferruginous matter, *i.e.*, decomposed iron pyrites, at the higher levels or beds, but which, at the deeper bottoms of these gutters or leads, remain in their original state as sulphurets.

The lithological character of the lower Tullochgorum wash or deep gravel deposits, on the other hand, as shown by the cores of the diamond drill, differs very materially from those just now described, as they exhibit in a gritty and, at the bottom, calcareous base rounded *pebbles* only of hard metamorphic schists, some of quartzite and greenstone only.

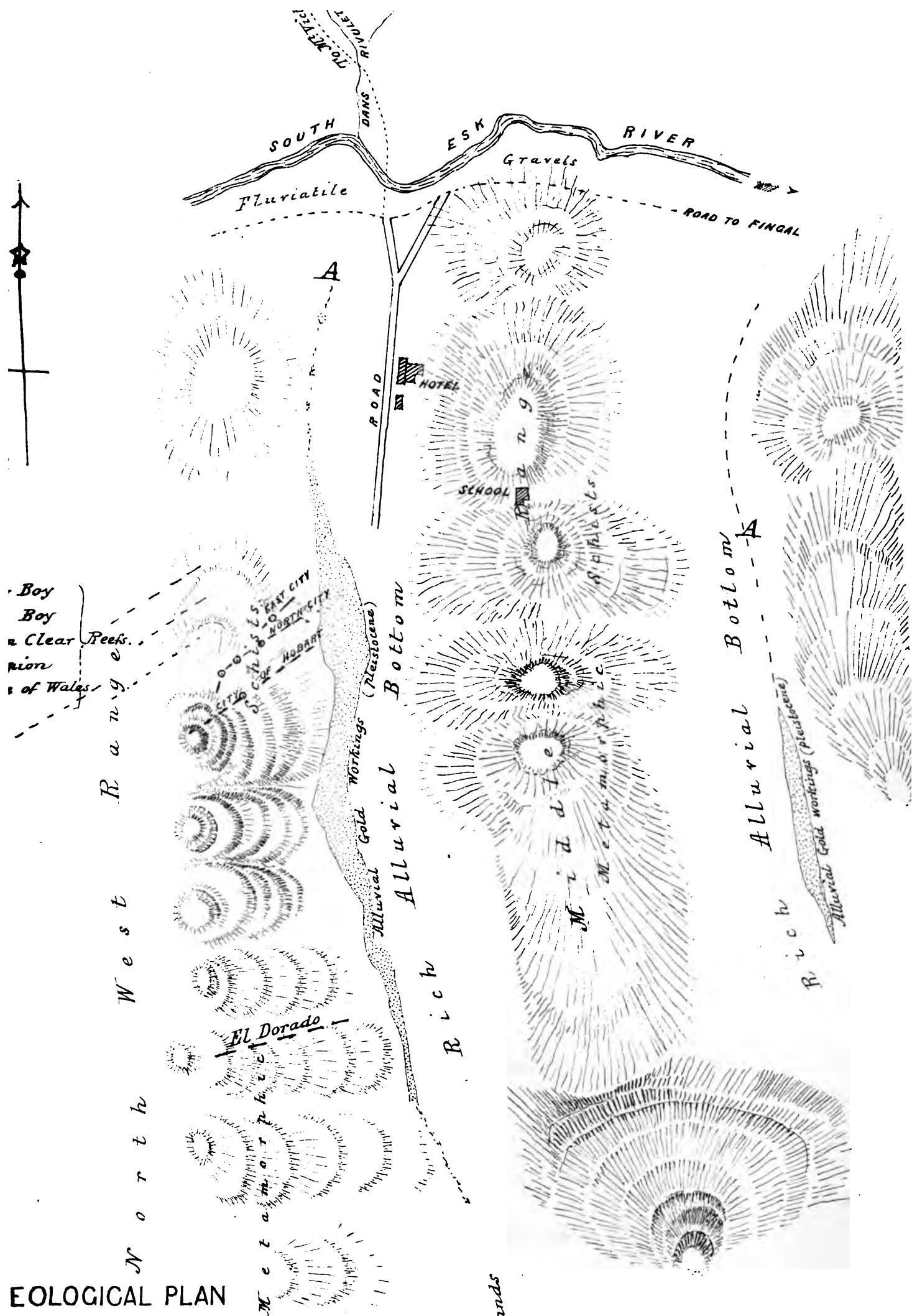
This latter mode of occurrence differs consequently altogether from the *true* pliocene gravels in the gold-producing countries mentioned, and from those also which have been found here in Tasmania beneath two distinct flows of basalt at Lefroy and the Back Creek, as described in my Reports Nos. 45 and 118 of 1882, and afterwards recorded by the Foreman of the No. 1 diamond drill.

Under these circumstances it would be interesting and probably instructive to wait further developments by means of the diamond drill, as the one core examined would not give sufficient data to form a decisive opinion upon, but at the same time it is quite probable that Mr. A. R. C. Selwyn's—formerly Director of the Geological Survey of Victoria, and now Director-General of the Geological Survey of the Dominion of Canada—opinion† on the *miocene*—older than the pliocene or lower gold drifts—of the Golden River and Moorabool deposits also applies to this deep ground. If I have been correctly informed, there exists here a *false bottom* near the Tullochgorum shaft, which to the east and south-east overlies the still deeper ground, held to be of the miocene era, overlying also at much less a depth a "gutter," the value of which has not been, on the same authority, sufficiently ascertained, nor have the tests of boreholes or workings been of a character to settle this important question definitely.

G. THUREAU, F.G.S.

* Winter's Freehold, Leviathan, City of Ballarat, and other mines ; also at Bendigo, Malmsbury, in Victoria, Alta Lead, California, and many other mining districts.

† Notes on the Physical Geography, Geology, and Mineralogy of Victoria, pages 21 to 26, by A. R. C. Selwyn, Director of the Geological Survey of Victoria : Melbourne, September, 1866.



EOLOGICAL PLAN of the CK BOY GOLD FIELD

— Quartz Reefs.

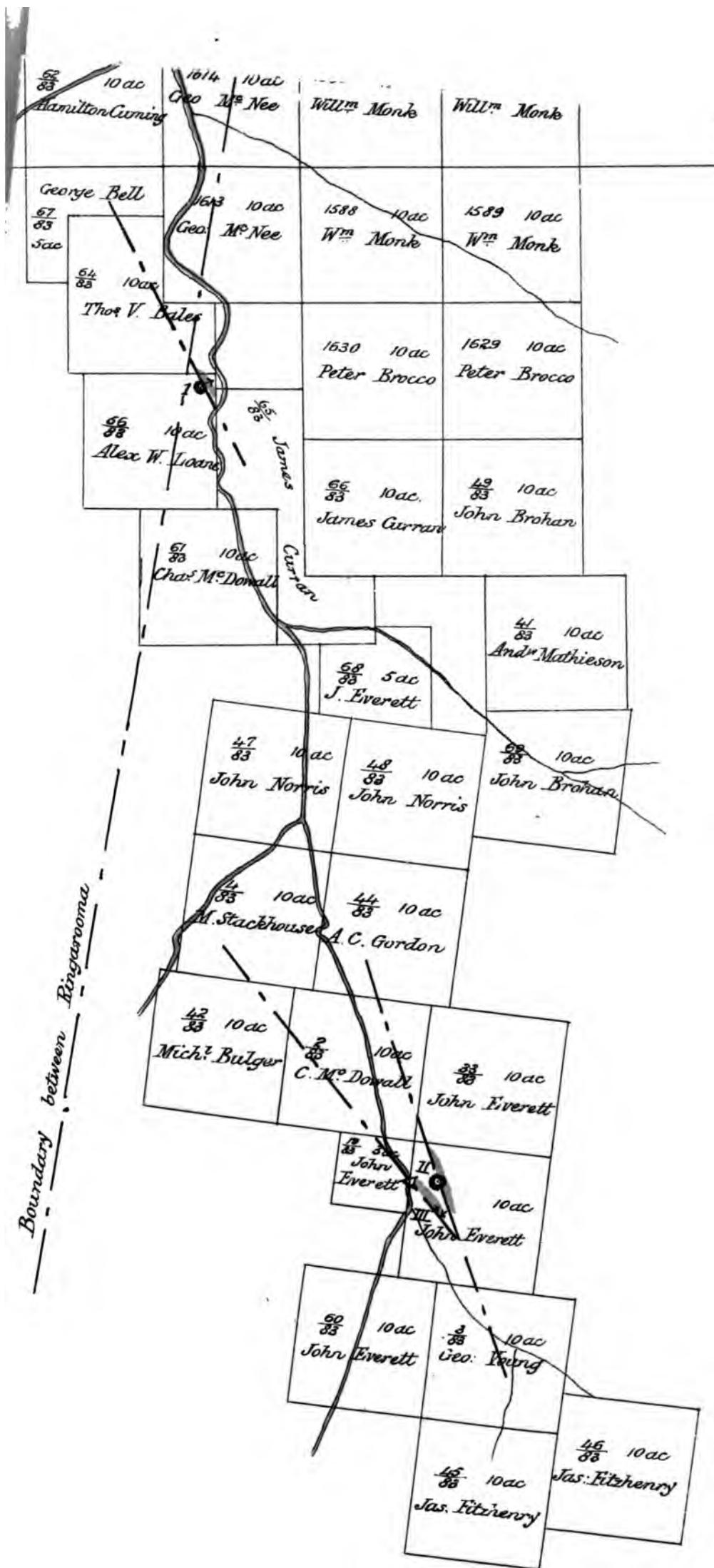
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E OF MINES 1885.

To high Table bairn

Note. Numerous gold bearing reefs and Quartz veins have been discovered and worked about this locality.

fecit G. Thureau F. G. S.





*REPORT on the Mount Claude Silver-Lead Mining Company's (Registered) Mines,
County Devon.*

Inspector of Mines Office, Launceston, March, 1885.

THESE Silver-Lead ore deposits were, it will be remembered, first examined, in accordance with the instructions of the Hon. C. O'Reilly, Minister of Lands and Works, in the latter part of 1880, the Report of which was forwarded to the Lands and Works Office on the 30th December, 1881.

During a period of over three years since elapsed a considerable amount of "dead work" has been carried out at these mines with a view of developing the ore deposits there extant. In order to deal with the whole matter, for the purposes of this Report it may now be submitted that as to the mode of occurrence of these argentiferous galenites, the opinion expressed in my first Report (page 6, after the words—"It is in the" &c.) has been fully borne out after the present examinations.

The present levels, drives, and other irregular workings still exhibit the ore in irregular veins, bunches, and pockets; and the statement also made in the first Report, that the driving of levels, sinking of winzes, &c., if adopted with such peculiarly formed deposits, would be found an expensive matter, has been verified thoroughly. In no case, now that I had a better opportunity to observe, could the deposits be classed as "Lodes;" and the style or system of working same on that erroneous supposition must have been expensive, without obtaining thereby a regular and continuous output of cleaned Silver-Lead ore. The so well known features characterising "proper" Lodes,—i.e., regular and continuous walls, the presence of largely developed vein-matter (such as calcites, barytes, and others) in which such ores occur in regularly laminated forms, a soft vein (*selvage* or "dig") at either walls—are here altogether wanting, so that they cannot be classed as lodes or vein deposits, but irregular pockets, veins, and bunches embedded in the joints of the country rocks adjacent.

Through this error of judgment the development of the mines has been retarded, and the outcome of ore has likewise been reduced to below what it should have been; besides that, the question as to the future and present commercial value of these deposits has been left in much the same position as before. In my opinion, therefore, there is no such thing as Nos. 1, 2, 3, 4, &c. lodes, and I consider, had the "terrace or open face system" been adopted as recommended, the greater portion of the cost of the main adit would have been obtained from the proceeds of ore thereby raised.

THE ARGENTIFEROUS GALENA DEPOSITS.

These have been opened by several irregular workings, chiefly located on the east side of Mount Claude Creek, at the base of the "Round Mountain," and two or three others west of the "Jug" and the upper waterfalls. On the creek the height of the "backs" on the visible ore deposits from the main adit would be about seventy feet, whilst the far end of that tunnel would command, and not exceed 230 feet. So far as could be ascertained, the *quality* of these ores had not deteriorated, but if anything they contained a considerably higher percentage of silver than what was tested in London, which satisfactory feature was doubtless due to those ores being less affected by surface and other decomposition. With regard to the extent of these deposits on their lines of "strike," it has also been proved that such is satisfactory, and that if judiciously opened and mined they can produce regular outputs of ore in such quantities as can be cleaned by the dressing machinery employed.

It was likewise observed in the "Jug," or No. 2 tunnel, that the ore was of more than the average thickness, of rich percentage, and that it impregnated the adjacent country rocks—a very perceptible improvement upon what was seen at my first examination.

The bearings of those ore-carrying "joints" in the No. 3 workings, as well as those east of the "Jug," (the latter about twenty feet vertical below the former), demonstrate a convergence at or near the boundary of the twelve-and-a-half acre section of this Company, in the direction of nearly the line of the mouth of the main tunnel.

At that junction, it is possible that a more defined and extensive deposit of ore may eventually be found, but this Report is dealing with the visible deposits *in situ*. It is, however, important for the Company to state that, from all appearances, the *central* surface metalliferous belt *dips* to the north-west; but as to the outcrops on the hill, where the huts are situated, and the veins (3) of ore intersected in the main tunnel, show, that there are, in all probability, other ore-carrying belts of strata running parallel with the former. Considering the distances as between the extreme eastern points, where the ores still continue to pass into the Round Mountain, and where their continuations have been intersected on the Huts Hill and in the main adit, these ore deposits evidently include a good-sized area, with unknown extensions beyond, and they deserve therefore, from their richness and facilities for working, to be wrought to their fullest extent.

It would not, however, be advisable for the present, and until more is known of these ore deposits nearer and at the surface, to continue that main adit, which has reached a length of 593 feet. In place thereof it is recommended to cut a siding track for a tramway up the Claude Creek, at such a grade and level as will give, say, thirty to forty feet of "backs" *beneath* the bottom or sole of workings east of the "Jug." It will be requisite (if my suggestions are adopted) if the "main tramway" cannot be utilised as its continuation—which would be preferable every way—to start near the main tunnel, and cross the Claude Creek higher up, by means of a culvert until within about twenty feet of the most western veins of ore; then gradually open out at that deeper level for a face 12 feet in width, being vertical at both east and west sides, until that very rich ore near the end of No. 2 tunnel (on plan) has been intersected, and taken down for dressing. Upon that being done, then to blast away the present roof of those eastern old workings in No. 2 tunnel; sort by hand the resulting ore until an eastern face or terrace has been formed at the extreme end of those old workings for further progressive operations. In this manner the Company would have an upper and a lower level and face to work a total (and increasing) height of stope of from sixty to eighty feet, all of which, interspersed with veins, bunches, and pockets of rich silver-lead ores, will be remunerative and eventually profitable to work after the preliminary works and dressing appliances have been constructed. This method of laying out the workings possesses other advantages besides, viz.—with the large quantity of spoil or *débris* a good-sized level dressing floor could be formed without cutting into the rock, and the water power available could be more directly, and therefore more effectively, conveyed to the machinery to be erected at such floors. Subsequently the western bank of the Claude Creek could be operated upon in a similar manner, and eventually the main adit could be utilised to a very considerable extent for the conveyance of ores from the deeper western faces to the lower ore-dressing floors.

In closing my Report I beg to draw particular attention to the suggestions of the future system of mining and crude dressing of ores; and I have but little doubt but that, if the mine management is placed into judicious and intelligent hands, the proceeds of these mines will become more and more satisfactory to the owners of the same.

G. THUREAU, F.G.S.

*The Chairman of the Board of Directors of the Mount Claude
Silver-Lead Mining Company (Registered), Latrobe.*



REPORT on the Silver-Lead Deposits near Mount Zeehan, Montagu County, West Coast of Tasmania.

Inspector of Mines Office, Launceston, 20th April, 1885.

THESE Silver-Lead ore deposits are situate at a distance of about five miles N. 5 deg. E. from Mount Zeehan, and at present they have been made accessible by means of a pack track, distant seven miles and three quarters from the Mount Heemskirk Tin Mining Company's mine, at the base of Mount Agnew, which latter is five miles from Trial Harbour, the nearest shipping port. Owing to the bad state of this track, the high rates ruling for freight along such a short distance previous to shipment would almost prove prohibitory to the success of these mines, were it not that Mr. Harman had discovered a much shorter and easier line of communication, so that this obstruction can only be regarded as temporary.

On inspection of these ore deposits, it may be premised, that I found but very little work done in order to expose their character for critical examination, the greatest depth of any of the workings being less than ten feet from the surface; and that, owing to their occurring chiefly in the beds of creeks, or in the adjacent rocky banks of same, a reliable opinion could be formed only with considerable difficulty.

With regard to the location of these ore deposits on the several sections, I found that such were as delineated on the Geological Sketch Plan accompanying this Report. The various outcrops of these ores were kindly shown me by Mr. Harman, and of these about twelve were seen, including the "Pyrites Lode."

Generally speaking, the presence of these argentiferous lead deposits was indicated by "caps" of *iron gossan*, which had penetrated through and formed a ferruginous conglomerate with the overlying alluvial gravels. In several instances a considerable width of such mineral matter was exhibited, which was held by some as demonstrating as proportionately great a width for the lodes or veins beneath, which, however, is an erroneous view to take under the circumstances. In no instance, so far as I could ascertain, would the width of any of these lodes and veins exceed (including the whole *gangue* and vein matter) five feet, and in that measurement the really valuable or metalliferous portion, consisting of silver-bearing galenites and sulphides of silver, may be put down at about a third of the whole. This applies, however, to two or three instances only, the remainder of the outcropping veins or lodes being less in size, the smallest only six inches in width,—constituting, however, the richest of any seen on those sections.

The general appearance of these lodes is of a very promising character, all the usual minerals associated generally with similar deposits elsewhere being present, and in several instances that laminated character peculiar to "true" lodes was clearly perceptible. The ores range from the rich argentiferous, steel-like-fractured with a bluish-gray hue, and sulphides of silver, to the rarer coarse-bright cubical galena, with a high percentage of lead. There is also, besides iron pyrites, zinc-blende and carbonates of iron, calcites, and probably a little carbonate of lead to be seen with these lodes.

On the whole, I may state that in my opinion these ores, properly dressed, will be found, after their preliminary calcination for desulphurisation, to be of a very free smelting character, if proper fluxes are used, and that their reduction into "alloys," and the cupellation of the latter for the contained silver, present no difficulty whatever.

As to the permanency of these deposits to a depth, the greatest extent to which any of these veins and lodes had been traced in its outcrop did not exceed three chains; but the work hitherto

done thereabouts appears to have been chiefly confined to the finding of ores in the creeks or in the rocky banks adjacent, thus leading to the discovery of lodes at, comparatively speaking, inconsiderable distances from each other; and therefore, it is submitted, no apprehension need be entertained of these lodes not continuing both laterally and vertically, if properly and systematically exploited. So far as practicable, the bearings of these various outcropping veins and lodes were ascertained by means of a prismatic compass, and, as will be seen from the plan, they vary, with the exception of No. 1 and No. 7, very considerably,—in fact, so much so as to render it quite possible of these outcrops either indicating *one* very irregularly formed fissure-lode, or of these various veins and lodes joining or crossing each other at such points as their respective “strike” through their adjacent wallrocks will permit. In either of these cases it does not appear to me of being of much consequence, or as materially interfering with the present and the prospective value of these valuable ore deposits.

These veins and lodes occur principally in soft or “kind” country rocks, *i.e.*, metamorphic schists, by means of which the mining operations are considerably facilitated.

Inasmuch as the preliminary expenses for opening these mineral deposits promise to be heavy in proportion to the system adopted for their development, and owing to the swampy nature of the ground, and also in consequence of the high rates for packing, until a proper tramway can be constructed I would suggest that the purer ores and what can be inexpensively dressed on the spot should be exported until such a time when these mines shall have been opened up by means of shafts and levels, &c., &c.

There is an ample supply of suitable timber standing on these leases and in their immediate vicinity which can at once be utilised for mining and smelting purposes, or at least so soon as the owners have decided upon a certain course of action regarding the working of these mines.

As a preliminary, I would strongly recommend the amalgamation upon any equitable basis of the leases referred to in this Report, because, judging from the general character of these veins and lodes, those situate to the west are most likely to be found at a greater depth of underlay by their northern neighbours, *viz.*, the Despatch Company. Much expenditure will likewise be saved by these respective owners by their taking preconcerted action, instead of separately frittering away money in unnecessary work and machinery, which has been unfortunately the case in so many instances in Tasmania. That amalgamation having been achieved, I would, as requested so to do, recommend that—(see Geological Sketch Plan):—

First. A new and sufficiently capacious flood-channel be cut from point *a* to *b* for the Silver-Lead Creek on Sections 562M and 559M, and also from point *c* to *d* on Sections 559M and 560M, in order to drain the ground from and about the outcrops of ore, and secure the future permanent workings from freshets and floods;

Secondly. To sink two new main shafts in such places as would command at a depth of, say, seventy feet, the whole of the adjacent ore deposits being thus freed from surface percolation of water.

Whilst the sinking of these shafts is proceeded with the principal lodes can be wrought for the production of ore simultaneously with the former, so far as circumstances will permit, and in order to reduce the current working expenses by the disposal of the ores raised and shipped.

Thirdly. As the heavy character of the ores after dressing or concentration will form a serious item according to the rates of freight from the mines, it is necessary, in my opinion, to consider the great saving which would accrue from the use, after construction, of smelting and refining furnaces for the final manipulation of these ores as raised from and dressed at the mines, as thereby their bulk will be much reduced for transporting the alloys resultant to the shipping port.

The “Pacific” smelting furnace has been reported of so notable a success at “Sunny Corner,” in New South Wales, and elsewhere, that its introduction here should not be lost sight of, as by its means the ores are deprived of all their dross, and it would enable the owners to export the alloys, *i.e.*, Silver-Lead “metal,” at considerable advantage to themselves.

The probable distance of a direct line of tramway from the mines to Trial Harbour would be about fourteen miles, using Mr. Harman’s new line of track. As to the cost per mile of such a tramway I cannot speak positively, as it will pass most of the distance to Mount Agnew through a forest, and afterwards over open and undulating country, but I think a narrow gauge line of tramway would not be very expensive.

From what I have seen of these Mount Zeehan Silver-Lead deposits, and after mature and careful consideration of the whole subject, I am of opinion that these deposits, if systematically opened, and when they are placed under good management, both for mining and ore-dressing at first, and ore smelting in future, capital could be safely invested for their development, and that they present a good opportunity for realising substantial profits in proportion to the amount of capital so invested.

G. THUREAU, F.G.S.

The Hon. the Minister of Lands and Works.

MEMO.—The results of assays made by the Government Analyst from *undressed* ore collected from all the outcrops indiscriminately by myself were telegraphed by B. Shaw, Esq., Secretary for Mines, Hobart, as follows:—

“ Per ton of ore : Metallic Lead, 43 per cent.; Silver, 37 ozs. 4 dwts. 19 grs.; Gold, 2 dwts. 15 grs.”

G. THUREAU, F.G.S.

Launceston, 23rd April, 1885.

(No. 129.)



1885.

PARLIAMENT OF TASMANIA.

NG RIVER AND MOUNT LYELL GOLD
FIELDS :

REPORT BY MR. COMMISSIONER GLOVER.

Presented to both Houses of Parliament by His Excellency's Command.



KING RIVER AND MOUNT LYELL GOLD FIELDS.

Trial Harbour, 19th September, 1885.

SIR,

HAVING just returned from a visit to the King River and Mount Lyell Gold-fields, I have the honor to submit the result of my observations thereon.

The only present operation in the vicinity of King River is that of the King River Prospecting and Gold Mining Association. Although so many lease sections were applied for adjoining those of the King River Company, nothing in the way of prospecting has yet taken place on any of them, and the holders seem to be still awaiting the operations of the Company mentioned. The mine of this Company is situated immediately contiguous to Lynch's Creek, where the original discoverer and others obtained a large quantity of gold two years ago. The main tunnel is 200 feet below the surface. In this the reef has been driven upon and proved for a space of 500 feet, its maximum width being 7 feet, the average width being 3 feet, and pronounced payable. Thirty feet of this distance consists of a "shoot" containing exceptionally rich stone, out of which prospects at the rate of 20 ozs. to the ton were taken, unpicked, from a face six inches in width. The reef has also been driven upon in the upper levels—in the 70 feet level, 245 feet, average width 2 feet, and payable; in the 33 feet level, 40 feet, 10 inches wide, and payable. The total length of tunnelling in the main level is 700 feet. The manager is still driving on the reef, having 3 men employed, and "paddocking" the stuff ready for crushing whenever the means shall be provided.

The other principal centre of gold-mining is situated in the vicinity of the Linda River, under Mounts Lyell and Owen, and is reached by what may be said to be literally a "wallaby track" made by prospectors and diggers through extremely broken, precipitous, and densely wooded country, and extending about eight miles, and crossing the Queen River twice by means of spars felled across the stream. In some places the traveller has to climb acclivities by the use of hands and feet, with the aid of roots and branches of trees. Added to this is the ever present mud, from 6 inches to 2 feet deep even on the steepest hills. The labours of the unfortunate gold-seekers, carrying from 50 lbs. to 80 lbs. on their backs, as the only means by which they can continue to inhabit the region, can be only slightly imagined by those who have not had personal experience of these tracks. But it is confidently stated by men well acquainted with the country in question that a good track can be obtained by means of the spurs of the hills without crossing the Queen River. This, however, belongs to another branch of the subject, of paramount importance to these gold-fields, if their development be desired, and which I purpose taking the liberty of bringing under the notice of the Government in a separate communication.

The Linda, a tributary of the King River, takes its rise among the lower hills on the eastern side at the base of that portion of the West Coast range known as Mounts Lyell and Owen; and in this locality are situated the present principal gold workings. On the summit of a lower ridge connecting these mountains a quartz prospecting claim is held by the Mount Lyell Prospecting Association, which consists of a co-operative working party of six members, with one special prospector. They also generally employ two extra men on wages. The prospecting operations proper of this association consist in excavating into the ridge mentioned with at present a face of about 20 feet in depth, which depth is nearly all "stripping," and consists mainly of immense rocks of iron ore—indeed, almost pure iron. These masses of iron ore are some 10 to 20 tons in weight, and necessitate, as may be supposed, a vast amount of labour, with appliances of screwjacks and dynamite to remove them, and the drilling operation for blasting is an extremely slow and laborious operation. The party have also secured under their Miners' Rights their quarter-acre claims for alluvial on this spot and below it, where there is a lead of surface gold of highly payable quality, but generally so fine as to be incapable of separation from the sand without the aid of mercury; and whilst following this lead into the hills they are very sanguine of

finding the reef from which the gold has been derived. There is also under foot on the ground where this party is working a large mass, apparently a continuous lode of pyrites, and persons assuming to be conversant with the subject are of opinion that this will prove to be the identical lode from which the gold has been shed. It is, however, to be regretted that the proprietors have never yet sent any portion of this pyrites for analysis. In the same working also occurs masses of a dark chocolate-coloured earthy matter, said to be "gossan," thickly impregnated with small grains of native copper. Down the face of the hill in the same line the soil contains fine gold on the surface. The party, whilst judiciously pursuing the work of prospecting for the reef, are simultaneously by the same operation working their alluvial claims by means of sluicing, with tolerably complete appliances for saving the fine gold. It is fortunate that payable gold is obtainable in the course of their work; were it otherwise it would be impossible for persons without considerable capital to meet the great expense of such operations in such a country, and what will probably prove to be a valuable discovery would have little chance of being ever accomplished. Many spots on the same slope of this ridge have been profitably worked by small parties by means of sluicing, from near the surface to four or five feet in depth. North of this locality, and about half a mile distant, is situated White's Creek. Here are located three other co-operative parties, two consisting of three men each, and one of four men. This creek was worked out and abandoned some 12 or 18 months ago, after yielding a large quantity of gold down to what was supposed to be the bottom. Extended claims of an acre, under the Regulations, have recently been taken up upon it, and the supposed "bottom" having been broken through, a lower deposit of auriferous character, judged to be payable by sluicing, was discovered. One of these parties, Messrs. M'Donough Brothers and Yieder, are sluicing a face of 30 feet deep, and they have not yet reached the bottom. I assisted in washing two dishes of earth, one taken from near the bottom, and the other from near the top of this face. The yield could not be entirely freed from sand, owing to the extreme fineness of the greater part of the gold. Having since weighed the mixture it showed 9 grs., but it is estimated to contain about 4 grs. of gold, which is considered an exceptionally satisfactory yield. The other claims are not so deep as this one, owing to the natural slope of the surface. The nature and appearance of the alluvial soil of the whole locality remind me forcibly of Beaconsfield; there are also fragments and pebbles of the peculiar conglomerate there called "cabbage-tree." Properly the whole of the alluvial wash should pass through a battery, and doubtless would do so if such were available; as it is, there is a vast quantity of indurated clay and soil which escapes disintegration in sluicing, and probably in some remotely future day these tailings will amply repay the enterprise of crushing them. Those enumerated are the only quasi-permanent works. There are several men in the various creeks and gullies about the Queen River, on the western side of the range, "gully-raking" and prospecting, with highly satisfactory success in some few instances, if it were not for the expense and great labour and loss of time in keeping themselves supplied with provisions in so inaccessible a place. The total number of men on the field is 35, but it is to be feared that on milder weather setting in a larger number will be tempted to try their fortune there. This is at present much to be deprecated, as such men will quit the place again immediately after experiencing the inexpressible hardship which is the inevitable condition of their remaining. It is quite useless to expect the development of this Gold Field until efficient pack-horse tracks to the King and Linda Rivers are provided. Notwithstanding its great promise it is impeded by natural obstacles, the removal of which must involve a very considerable lapse of time, even if the necessary pecuniary means were at once available.

I have the honor to be,
Sir,

Your most obedient Servant,

W. H. GLOVER,
Commissioner of Gold Fields.

BERNARD SHAW, *Esquire, Secretary of Mines.*

(No. 72.)



1886.

PARLIAMENT OF TASMANIA.

**BLUE TIER MINING DISTRICT AND ITS
TIN DEPOSITS:**

REPORT BY INSPECTOR OF MINES.

Presented to both Houses of Parliament by His Excellency's Command.



REPORT on the Blue Tier Mining District and its Tin Deposits.

*Inspector of Mines Office, Launceston,
February, 1886.*

GENERAL GEOLOGICAL FEATURES.

THE prevailing country rock or formation consists of a coarse-grained granite, in which large crystals of reddish felspar (orthoclase) are embedded with quartz and blackish mica; this rock is hugely stratified, and frequently the felspars form regular bands or lines, conveying a kind of laminated appearance to the whole formation. In this "primary" rock the *lodes* of tin ore occur, also *dykes* and *belts* of more recently obtruded porphyries, which latter belong to the aplite and protogine series. These dykes are more or less impregnated with fine black tin ores, whereas in the lodes it occurs in regular veins, nests, and bunches in the vein-matter, and they are therefore in a more concentrated form than in the dykes. The ores are chiefly those of oxides of tin (cassiterites) associated, in the lodes more than in the dykes, with copper, iron, molybdenum, pyrites, wolframite, and siderite, some fluor and calc spar and talcose minerals.

The really valuable metalliferous deposits may be classified as follows:—

1. Lodes.
2. Dykes (indurated or hard.)
 Ditto, (soft.)
3. "Soft Formation," or "Great Fault."
4. Dykes; basaltic or of anamesite. These latter are frequently decomposed near the surface into yellow, brown, or grey soft rocks; underground they are very hard and dense, and of a black colour, enclosing arragonites and leucites.

The lodes and dykes of the two first classes produced, at the surface, through atmospherical and aqueous action, those rich pliocene (older) and pleistocene (recent) alluvial tin ore deposits which have been wrought in this district for over eight years past with great success, but which are now nearly deprived of their mineral treasures. These would form the 4th and 5th divisions. It may be remarked that the latter extend over considerable areas, and they have produced large returns of tin ore for export.*†

Description of Mines and their Deposits according to Classification.

1. **LODES**—Lottah, Full Moon, Hope, Blue River, Wellington, Connelly's Companies, and Cream Creek.

The *Lottah* Company's ground is very favourably situated for working their lodes, of which there are two or three, on an economical system, on account of the deep valley in which their outcrops are located. About 60 feet above the creek the main adit has been driven along the course of the lode from its outcrop for a total length of 800 feet; and two other tunnels or crosscuts had

* It may be stated, that information has been obtained from reliable sources to the effect of this Blue Tier Mining District having yielded during the period mentioned over 3000 tons of tin ore, which, at a low computation of Fifty Pounds sterling per ton, has added £150,000 to our exports, or over £21,000 per annum.

† The description of the geological features and location of deposits is almost impossible without a geological plan, to which, as it accompanies this report, attention is repeatedly directed.

also been extended 780 feet in the same manner, and a crosscut 80 feet in length intersected that lode at the higher level. There were no winzes sunk to connect on the underlay of the lode, but two vertical air-shafts are completed; these main workings therefore command about 260 feet of solid ground or "backs" on the underlay, and so far as these tunnels show, the lode extends throughout the full length of the ground, and further. Besides the one disclosed in these tunnels there are two others not yet developed, but which exhibit good ore in veins at an altitude which adds over 150 feet to the back available for working. These vein deposits are, on the whole, very regular in their mode of occurrence for an average width of from two to three feet, and they carry a very good percentage of tin ore of a very coarse and brittle description wherever they have been tested. It need scarcely be added that their permanency has been established by the extent of their workings, and by the occurrence in them of the usual percentage of those minerals generally associated with lodes here and elsewhere, and referred to in the first part of this Report. As the deposits observe a strongly laminated character in grey and red granite, also protogine wall-rock, it has been found, however, that the darker or black portions are the richest in tin ores. There is scarcely any room for doubting but that, even without proper and effective concentrating appliances, this company has not only proved the extent and value of their lodes, but that they are therefore justified to proceed with the purchase and erection of grinding and cleansing machinery, and thus end their present state of inactivity. As a preliminary, it is here suggested that all these main workings be connected forthwith by means of winzes and passes in order to facilitate the actual mining of ore exclusively.

Attention should also be directed to the fact that this company holds, so to speak, the key of position of other and deeper adits, by means of which, eventually, the following mines—viz., Full Moon, Hope, and others in the vicinity—could be worked at greater depths on a very economical scale, and which proprietaries are now prevented in a great measure from doing through their having to work their lodes by means of shafts in a very expensive and tedious manner, owing to the gradual but increasing influx of water at depths.

The Full Moon Company (late)—see Plan No. 1—have sunk their principal working shaft to a depth of 120 and another of 100 feet from the surface. At the lower levels water was encountered, which rendered mining operations very expensive. There are two principal lodes dipping towards each other, and these were worked at short distances from the shafts, and the yields have been equal, on average, to those of the ground opened at the higher levels. The deposits, vein and alluvial, yielded large returns for some time, and the former are now turning out, when water is available, payable returns. So far as could be seen, the workings being full of water, the character of the vein-stone from the deeper levels as deposited on the surface was very similar to that from the Lottah Company. The tin ore occurs in coarse crystals in veins and nests, embedded in large transmuted talcose vein-matter.

It may, however, be remarked that molybdenite and sulphurets of copper were found more frequently in these lodes, and that dykes of "basalt" of a more recent origin than this remarkable set or system of lodes intersected the whole of these metalliferous veins. These deposits, as already mentioned, gave large yields, both from the recent and older formations, as they, in a very few years, gave to a limited number of miners, and, later on, to a company, down to the 100 feet level, 875 tons of ore, at the estimated value of £36,000, of which sum £20,000 was distributed amongst the shareholders as profits, who had commenced with a working capital of but £6500.

In view of these facts it appears as most surprising that both the Lottah and the Full Moon Companies should remain for so very considerable a time at a standstill, so far as their operations on the lode formations are concerned, when it is quite evident that, in both cases, a moderate expenditure, judiciously laid out, would, from all appearances, have sufficed to place them in the dividend list.

The Hope Company has opened its mines on the leases, on a formation of a series of tin-bearing veins on the surface, and, as a matter of fact, it may be stated of their three companies,—viz., Lottah, Full Moon, and Hope,—that they occupy positions at different altitudes on the same metalliferous belt traversing that region, the proper development of which, at considerably greater depths, should, for reasons advanced, proceed from the valley in the Lottah ground. The initiation and accomplishment of such a scheme would undoubtedly be fraught with the greatest importance to this otherwise almost depopulated district and the Colony at large.

The Blue River Company has found on the north side of that peculiar "soft formation" described further on, a number of parallel running veins—east, west,—extending over a distance of 4 to 6 chains. They are, if anything, of an impure quartzose character, carrying a moderate percentage of "rosin" and black tin ore. A great deal of trenching has been done thereabouts, and also two shafts have been sunk to depths from 16 to 25 feet respectively, in order to test same thoroughly, as they occur in soft country, the veins themselves being of a hard character. The one known as No. 3 appears to be so far the most promising of the others, and, to judge from its general character, a greater depth would solve the question of these veins being remunerative in a practical manner, and which should have my approval.

The Wellington Company has, by means of a main tunnel, intersected several promising tin lodes, which are decidedly more clearly defined, rich, and contain more quartz and mica than several of the others at Blue Tier, and they give promise to turn out well when once systematically mined, and the cleansed ores have been collected by the more superior concentrating appliances. The first lode, 300 feet from the mouth of the tunnel, is 12 feet in width, exhibits a kind of porphyritic but still laminated appearance, as the various constituents of the lode occur in vertical bands. Several samples were taken from a width of 6 feet from the north wall, and they produced by washing (thus proving the kind nature of this valuable formation) very satisfactory results of samples of coarsish black tin ore. A dyke of hard and black basalt (anamesite) 2 feet 6 inches wide traversed this lode, which strikes nearly due east by west in a north east by south west direction, and similar volcanic dykes are nearly always found in conjunction with permanent formations of a metalliferous description. In the total length of this tunnel of 450 feet from north to south, other lodes have been met with, viz.—the second lode occurs 17 feet to the south of the one just described; it is but 1 foot wide, but it also carries fine ore. At 25 feet further along the tunnel the third lode was found, of a similar thickness, in a soft vein-matter, and of similar quality to the last. Unlike the first lode, which has had a winze sunk upon it for a depth of 80 feet from the surface to and connected with the tunnel, this lode has a shaft but 35 feet sunk, leaving about 50 feet to hole through; the first shaft will facilitate the working of the lode very much at start and after.

A chain wide of dead country follows or intervenes before the fourth and last lode was met with. This partakes more of the nature of an immense "stockwork," as forty feet have been driven in same, but the opposite wall has not yet been reached, though moderately fair prospects of tin ore can be occasionally obtained. It is therefore very certain that in these four lodes, though they differ in the tunnel in quality, a very valuable property exists, which, however, has been very much neglected, owing principally to the want of some inexpensive reduction process, which appears to me to be the great *desideratum* on the Blue Tier, through which, if anything, it has simply suffered a relapse from its former mining prosperity by the gradual lessening of the product from alluvial tin mines, and from the want of knowledge to work other deposits of that ore, which require certainly some outlay for shafts, winzes, levels, and machinery, but which, if those things were once supplied, would have given, if not quite, equal yields for perhaps a lesser number of employés, would have been preferable, as the deposits are, so far as my examinations have convinced me, of a reliable permanent character, capable of gradual extension, both of the mines and the machinery to be employed.

The Cream Creek Lode, in the north-western part of the district, consists of a vertical vein of blackish tin ore: and, singularly enough, it was discovered by sinking through granite, which caps it. Some experts, not having examined that coarse granite, failed to discern the closer-grained apex of a porphyritic dyke in which that lode occurs, and declared the granite as devoid of metalliferous deposits, showing how unwise it is to lay down hard-and-fast rules in these matters when large amounts of money may be at stake. The lode varies from 2 to 3 feet in width, and it carries rich ore, and it is besides remarkable from its outcrop being largely impregnated with black manganese in botryoidal forms.

The Connelly's Lodes occur, as per plan, in the north, and at nearly the highest point of the Blue Tier, being over 700 feet above the Blue Tier township (A.). The formation exhibits a series of quartz veins stained green, probably by chlorite, enclosed between two walls which are about 2 feet apart. The tin ore is irregularly distributed, but it is evident that periodically it must have been rich, as the shallow gully alongside yielded 24 tons of pure ore in a short time. There are two outcrops which vary in strike a little, but it is evident that they belong to the same formation.

2. Dykes (*indurated or hard.*)

The Anchor Company's (No. 8) mines are situated in the extreme south-eastern portion of the Blue Tier district, and about 500 feet below the level of the Lower Junction Township (B on plan), and it is singular that there is some kind of similarity between its deposits and those at Cream Creek, in the north west. As regards the question of developing this particular concern (Anchor) into a productive mine, much has been said and done, and I offer the following remarks with a view of elucidating the matters and in aiding towards so desirable an end. In this case it is to be regretted that the greater portion of the capital of the Company was lavishly and needlessly expended in the purchase and the erection of very costly, cumbersome, and powerful machinery for crushing and concentration purposes, and by no means perfect in the way of achieving the results aimed at.* Some allowance would have been made had the management assured themselves as to extent, character, and possible value of their tin-ore deposits; but there is no evidence to that effect, so far as I could see. The outcrops of this hard dyke have been laid under contribution wherever the ore appeared most plentiful, which operations involved a very unsystematic method for supplying, at uncertain periods, the batteries, with crushing dirt. This is proved that, in some instances, in order to get at the richer ores, the accumulated *debris* had to be moved again and again, at great expense.

* List of machinery:—One waterwheel, 60 feet diameter by 4 feet 6 inches breast, 40 heads of stampers, 4 classifiers, 8 Lewis's patent buddles, 2 slime-tables, and a number of settling-boxes, tossing-tubs, tyres, spinal buddle, &c., &c.

In order to arrive at some conclusion as to the probable future value of these ore-deposits, a very careful examination was made, with the following results; viz.—

The mines, or, more aptly speaking, "faces," consist of open "cuttings" into the sides of narrow gulches, filled at the top end with heavy and large boulders of granite rocks. The tin ore is exhibited exclusively in a hard dyke of quartzose "porphyrite," unmistakably different from the coarse-grained granite enclosing the former. In this dyke occur numerous "slides" and "friction-joints," indicated by striated veins of white steatite, but there is no regularity in the direction or extent observable with these joints. It simply appears as if this porphyritic mass (irregularly impregnated with rich tin ores) formed a huge wedge-like intrusion or upheaval through the coarse and primary granite, in a direction from the east-north-east, as the dip is in that direction (see Plan No. 2.) What is termed the "West Face" exhibits at its limits a greenish vein of mineral (chlorite), with an underlie of from 70 to 80 degrees to the south east, whilst the corresponding and opposite wall, not yet quite so well defined, underlies at an angle of but 53 to 60 degrees to the north west, thus indicating a close approach, if not a junction, of both walls at an inconsiderable distance from the surface. The bearings of these walls also vary, that of the western wall being north 74 degrees east, and that at the east wall (Perry's) being north 72 degrees east, making both converge in the east north-east, proving, amongst other things, that the subsequent periodical denudations have, in the gulch, removed the top or "cap" of this dyke, whereby this metalliferous formation was exposed to the prospector and discoverer. Having thus ascertained the position and the limits of this remarkable dyke, it should likewise be stated that, at the then working level at Perry's face, the two walls were 150 feet, whereas, at the surface outcrop of both walls they are over 400 feet apart. At Perry's face the present main tunnel would command about 80 feet of backs, and less than 45 feet on the "West Face"—Robinson's workings being located on and embracing the north-western remnants of the wall at that part of this dyke. The large boulders, some of which are tin-bearing, are simply fragments forced into their present secondary position by denudation.

The Workings.—These have already been referred to in a general way, and they are, with the exception of the tramways and the completed portion of the main tunnel connecting with the batteries, of a primitive description, not calculated to supply the mills, &c. with a regular supply of the better class of ore, as shown all along by the low percentages obtained from large parcels crushed and manipulated upon. During my examinations in February, 1885, it came to my knowledge that a new and, as I found it to be, *very* promising discovery had been made immediately under Perry's "face," showing quite a change, in a dark blue schistose porphyry of a high mineralised description, as such minerals had not before been seen in the dyke; they included molybdenites, galenites, iron pyrites, and *very* rich tin ores. The "joints" and "digs" of this formation were filled with soft mineral matter also charged with very good percentages of tin ore; and it is specially worthy of notice that even better ore was seen under foot for a width of over 9 feet, with indications of widening at greater depths. This new deposit—*within the dyke*—could not be wrought on an extensive scale except by means of an extension of the main tunnel and a winze sunk from the present workings to connect with the former. The new formation is well marked in its footwall, but, so far, the hanging wall had not yet been found. I came to the conclusion that the future welfare of this proprietary entirely depended upon the works suggested, viz., the extension of the main tunnel and the connection of it by means of a winze. That would give about 25 to 30 feet of "backs," which would be quite sufficient, in my opinion, to obtain direct evidence as to the value of this promising discovery, which must give a higher percentage of ore per ton, as the mining expenses are larger on account of its greater hardness to mine it to be remunerative.

On my second visit operations had been suspended at the mines, but I learned that, under a change of management meanwhile, that the ores had been procured wherever get-at-able, and that the main tunnel and the new discovery were still unconnected, thus accounting for the low average yields per ton, which were reported at about one per cent. And in this manner a mining venture which promised so well for the owners, and the stock of which reached high prices, was simply made a large loss to them through, firstly, not ascertaining the extent, character, and average value by means of systematic mining operations; and, secondly, before doing that so very necessary work, to follow the pernicious example set on the West Coast, by purchasing and erecting too powerful and extensive crushing and concentration machinery for the water available on the spot; and as regards the cleansing plant, it has been stated in the press as somewhat defective for saving a similar percentage of ore as is generally achieved by appliances of that kind, but worked upon different principles. Amongst other things my attention was drawn to a large cutting which cost thousands of pounds, it was stated, for a return of about ten tons of ore.

The Blue Tier Company's ground is traversed by no less than four dykes of this class, numbered 6, 5, 3, and 4 respectively on the plan. No. 6 is located near the top of Charcoal Gully, and it was traced through the occurrence of "float" specimens, exhibiting acutely-angled crystalline tin ores, in a terrace of tertiary drift (older), until the northern wall of this dyke was met with, showing a little fine tin, but as the coarser tin still continues to be found, the southern or opposite wall will in every probability be found more prolific. The No. 5 dyke resembles, in a granite country, a huge bed of hard sandstone some chains in width, carrying, so far as has been ascertained, a very

moderate percentage of ore. The E. L. dyke on L. F. Downing's section observes a due north by south strike for a considerable distance; in a hollow it was proved for a width of 20 feet, decreasing to 2 feet at its southern extremity, where a gradual change takes place from a porphyritic rock into a more crystalline, in which the component parts are very strongly defined as laminated bands of felspar, quartz, and especially fine crystallized tin ores. This appears to be a very promising deposit, and the occurrence of a dyke of basalt cannot be overlooked as an additionally good indication.

As the alluvial tin deposits appear here, and in most other leases, to have had almost exclusive attention hitherto, owing chiefly to the urgent want of an inexpensive reduction plant to separate the ores from their matrices, the development of these tin-bearing lodes and dykes has not been carried on with assiduity and, perhaps, forethought,—excusable indeed in times when pure alluvial tin ores could be and were being obtained at very little trouble and expense—or else, in this instance at least, a test would have been made of the point where the E. L. dyke and another on H. A. Downing's section (No. 4), bearing S. 41° W., are, from all appearances, likely to form a junction, which is usually favourable to the heavier deposits of ores. This latter formation is 12 feet in width on average, well charged with coarse tin ore; in crossing Velocipede Creek nearly 2 tons of impure ore were obtained in the alluvial in a short time, but it was much interspersed with quartz and porphyry; other tin-bearing veins were also met with in that vicinity, associated with large flakey mica.

The Kent Company (2) have also traced, through means of their extensive alluvial tin deposits, the ore to at least one of the sources, which consists of a hard porphyritic dyke carrying these ores. It is about 2 chains in width, with a strike of N. 11° W., and it contains irregular streaks and nests of fine ore, so fine, indeed, as to render it very difficult to save it by any kind of concentrator extant. Some ochreous deposits in a gully likewise deserve the attention of this proprietary.

The Cream Creek Leases. (1 on Plan)—Messrs. Murdoch and Alexander proprietors—contains some of the richest tin ore deposits in this rich district, and on which a large amount of labour has already been expended, but so far no systematic opening of the permanent formations has been attempted, though, as an inducement, the gravels in the gullies have yielded, in a very short period, over two hundred tons of ore. This proprietary is suffering from a drawback, the removal of which should not be omitted now that the permanent formations have been defined and found to extend over a considerable area. The want of direct and passable pack-horse tracks or dray-roads causes much delay in sending away the ores and in forwarding the supplies to the miners employed in that and the adjacent districts; it would not be very expensive to construct a main track or dray-road to connect with the track already made to the Kent Company's mines, and thus establish a route with Blue Tier township and thence to George's Bay.

The formation at Cream Creek (No. 1 on Plan) consists of a large dyke (besides the load already mentioned), different in its geological and mineralogical character from any other in this district. It has a more crystalline appearance than any other, and permits its component parts to be distinguished without much difficulty, the predominating parts being quartz,* decomposed grey felspars, mica, and, in spots and veins, tin ores, chiefly of the semi-transparent description (wood), also, in less proportions, sulphurets of copper, iron, and carbonate of iron. In the lower cuttings, nearer the Frome River, the dyke has a bearing of N. 42° E. for a width of over 4 chains, which, however, decreases up the range, a distance of $\frac{1}{4}$ mile, to 10 feet for a corresponding diminution at the farther extremity of its metalliferous contents; at about midway on the north-western flanks of the range some extremely rich ore was found to permeate this porphyritic dyke. It is, however, to be noticed that the whole dyke formation dips to the north-east, and it is eventually overlaid by a coarse granite (orthoclase) in a very similar manner, as noticed at the Anchor mines. From the level of the huts close to the Frome River over 200 feet in height for "backs" can be obtained at the extremity of the dyke on the range, and the whole situation is very favourable for carrying on extensive mining operations, as water can likewise be brought at such a level† as to give sufficient pressure for working motors to be used in connection with crushing and cleansing machinery in future, up to any power that may be found necessary.

2. Dykes (soft.)

The Masher Company (9 on Plan) have opened a soft tin-bearing porphyritic formation bearing N. 16° E., five feet in width, and dipping to the south. It is principally composed of decomposed and transmuted felspar (steatite) and quartz, the whole dyke being embedded in the usual coarse granite formation of this district. It can be the more easily distinguished from the latter on account of its deep brown colour and soft character. The dyke has been followed, carrying rich tin-stones, for a distance of several chains, but at a depth of but 18 feet from the surface the influx of water hindered further progress.

* It is noticeable that whenever these dykes become more quartziferous the tin ore is more abundant, and occurs in coarse crystals or crystalline veins.

† Some 4 to 500 feet above the level near the huts.

The Camp Creek (10 on Plan) dyke observes a strike to the north west. It is about one chain wide, and it presents the appearance of a coarse kind of sandstone in the ordinary granite. Closer examination proves it to be composed of chiefly quartz, decomposed felspar, a little mica, and, so far, a very moderate percentage of black tin ore. There appears, however, some probability of the tin ores becoming more frequent on approaching the Wellington group of lodes.

The Haley's Dyke formation (7 on plan) may be considered as the most valuable of that kind in this district, on account of its general productiveness from an easily-worked and friable tin-bearing rock (aplite*), regularity of strike, and walls of the usual hard granite. This dyke has been traced, with the exception of a not quite clearly defined interruption and lateral displacement by means of the "soft formation," for a distance of about two miles. This remarkable dyke occurs in the hard country, measuring from four feet to one chain in width, and whereas the somewhat indistinct "bedding" joints of the enclosing granite are north 11 degrees east, the dyke itself strikes, on the average, north 4 degrees west. The enclosed tin ore, which is of a fine crystalline character, deep black in colour, more or less impregnates the whole formation, which, being very friable, permits the hewn-out rock to be at once treated in the sluice-boxes, whereby but one-eighth of the residues—harder fragments—remain as non-dissolvable by water. The dyke is marked at each wall by a kind of a soft selvage or "dig," and passes gradually into the enclosing granite. The extension along its strike would alone prove its permanency to great depths, in conformity with other similar ore deposits, though it may become eventually harder, and necessitate the use of machinery for reducing same; but as the ore is already very fine, and a considerable percentage of the "slimes" is even now lost in sluicing, the introduction of self-regulating "rollers" or other appliances non-productive of slimes would appear as preferable to the ordinary stamp-heads in batteries.

The following proprietaries hold possession of portions of this Haley's Dyke; viz.—Haley's (late), Haley's Extended, Blue River, Lottah Extended.

With reference to the question of working this rich dyke to the best advantage, it is very doubtful whether the Haley's Company could have succeeded in making their venture a remunerative one, judging from the manner in which their principal workings have been laid out, and, to a great extent, completed. The mining operations were of so simple a character that with ordinary skill large returns of tin ore could have been produced whenever water was available—in fact, with that requirement supplied, this mine should have been amongst the dividend-paying concerns from almost the beginning. It cannot be pleaded that the extent and value of this formation was not known at the time, because the dyke crops to the surface all throughout the leaseholds, except in a gully where a thin stratum of alluvial—rich just there—covered the same; besides that, a shaft was sunk at that time 10 chains south from that gully, in excellent tin-stuff, to a depth of over 20 feet, and an adit was started under the then management along its course to the south, by means of which only about 30 feet of backs would be obtained, which, in practice, is quite insufficient to recompense the owners for the outlay, and to leave an adequate profit upon the transaction. It may be stated that I deem it my duty to call attention to these cases of want of foresight, skill, and practical experience, because the mining interests of this Colony have suffered so much from same as to damage the mineral resources we undoubtedly possess in quite an undeserved manner.

In order to illustrate the manner in which, in this case, from all appearances, the lack of practical knowledge led to the loss of a rich mine to those who had invested in a *bona fide* manner, the plan and section (No. 3) is added to this Report, as taken from actual survey. As stated before, that adit was commenced *on the course* of Haley's Dyke, and after driving some 60 feet, for some unaccountable reason the former course (south 10 degrees east) was altered to south 12 degrees west, or direct into the hardest country in this district.

Three hundred and forty feet were thus driven, at a cost scarcely less than £4 10s. per foot, and connected with a shaft 30 feet deep, also sunk in the hard rock at similar cost per foot; after that the adit was continued for 60 feet south 20 degrees east, when, in a total of 200 feet, the southern shaft, sunk in the richest portion of the dyke, would have been met with. In other words, nine chains or thereabouts were left standing of this valuable dyke, and the money was spent in driving and sinking 430 feet, in the aggregate, in the hardest country, thereby and in other respects, without the slightest advantage, crippling, if not exhausting, the resources of the Company, and leading to the collapse and loss of a valuable mine possessing every advantage for economical working. Having been there in February and December last year, the product of the mine, as at present worked by *two men only*, viz., one to break out the dyke stone and wheel it to the sluice-box, and one man sluicing, averaged one bucket of pure ore per diem, or in value to about £2 13s. for their day's labour. Had the useless working in hard rock not been carried out, and the capital expended instead in the reservation of water, the Company would have derived immediate results from their property commensurate with the number of men employed in the mine and at the sluice-boxes.

* "The term 'aplite,'—a plutonic rock, more recent, as all the rest of porphyritic dykes on this field,—is applied to a rock composed principally of quartz, a little mica, and a greenish decomposed felspar, and more or less tin ore,—black in colour."

The Haley's Extended Co., north of the last-described but now defunct proprietary, as it has been sold and re-bought by some of the original owners, has proved the continuation of the dyke to the north, in which direction the Blue River Co. have in a like manner succeeded in discovering tin ore in this dyke. In the Haley's Extended leases the dyke averages one chain in width, of which the central portion, being also softer, appears to be the richest in ore.

To the south of the late Haley's Co.'s holdings the Lottah Extended Co. have likewise traced this stanniferous dyke for a considerable distance, and it assimilates geologically and mineralogically to the other portions mentioned above; one of their shafts was sunk to a depth of 60 feet, proving the dyke to be, at that depth, still as rich in ore as anywhere else on its course. Owing probably to the interference or contact with a basaltic dyke bearing south 60 degrees east, this (Haley's) dyke assumed a different appearance, becoming more quartzose in character, and a rough test gave at the rate of 7½ per cent. of fine tin ore to the ton.

3. *The "Soft Formation," or the "Great Fault."*

The Blue Tier Company (IV.) were the first to discover, near the head of a tributary of the Blue River, this singular formation; at that spot the actual width of it has not yet been ascertained, as between wall and wall, and the whole of it consists of a soft clayish felspathic mass, white to reddish in colour, interspersed with quartz veins stained green in places—where the tin ore chiefly occurs—by chlorites. The percentage of tin ore is very encouraging for this kind of formation, seeing that little has been done beyond the cutting of a few trenches, some of them over 30 feet long, and small shafts, 8 to 10 feet deep, to develop the same. The formation exhibits a peculiar soft ochreous outcrop, chiefly beneath the alluvial, which has been removed since, leading to its discovery, and samples tried in the pan gave up to 4 ozs. of very pure ore, and for this and other reasons it deserves more attention than what has been at present bestowed upon it. Occurring, as it does, between two hard granite walls, its singular appearance attracted early attention on account of the vivid colours exhibited, which include the deep brown (ochre), yellowish, bluish-grey, mottled white to flesh colour and green (chlorite), and the whole of which has proved to be tin-bearing for a distance of three miles and a half.

Having closely examined this formation in all its ramifications from the Wellington Company's sections to those of Thomas Haley in the east, or numbered I. II. III. IV. V. on the plan, it appears to me that the terms "vein" or "dyke" are inappropriate, and that therefore, in my opinion, it constitutes a break or "fault" (disruption) of the country rocks, causing what to us is the more important matter, the severance of a number of tin-bearing lodes and dykes of porphyry, such "break" taking place at a more recent period than those older and permanent ore deposits. The soft nature of this formation would thus be readily accounted for, as it is the product of extreme friction of the hard rocks on either side of that divisional joint, productive of immense heat, during which process the present quota of tin ores were obtained from the stanniferous lodes and dykes disrupted; the ochreous substances and the acidic water oozing from this fault at various places indicate at deeper levels, the existence of deposits of sulphurets associated with tin ores. The closer connection of the Wellington lode with this soft formation has been satisfactorily proved, as their principal lodes occur within the lines of same, and others may yet be found. It cannot be doubted but that this "fault" will eventually become the means of discovering other not yet known ore deposits, and, as a secondary consideration, prove the Wellington, the South and Blue River lodes on the north to belong to a parallel group of deposits, the "heave" or "throw" accounting for the difference in their present position by means of that "fault."

4. *Dykes (Basaltic or of Anamesite).*

These occur in conjunction with, but are of more recent origin, than any of the tin-bearing lodes, veins, and dykes, and in general, they resemble the dyke in the adit driven at Mount Victoria by the Crown Prince G. M. Co., and, more so, those in the Sandhurst and Castlemaine mining districts (Victoria). In the two last-named places these dykes are regarded with considerable favour by mining experts as leading to rich metalliferous and mineral deposits. As the only point of volcanic eruption in this locality is found at Mount St. Michael, the dykes will have to be attributed to that "vent" in regard to their origin. They occur at the Full Moon, Wellington Lodes, and the Haley's (Lottah Extended), and Blue River dykes of porphyry.

A peculiar feature obtains in this district,—viz., the occurrence of hard highly quartzose and coarsely micaceous bands of rocks of a crystalline character, and very easily to be distinguished from the adjacent granite. With the gradual wearing away of the softer granite these bands remained, and in some places, marked F on the plan, they form obstructions or "bars" to the general drainage of the country, in this manner preserving on their upper sides the older pliocene stanniferous gravels intact, which, however, the more recent drainage has in most parts obliterated, and substituted the recent pleistocene gravels. In some parts of the Wyniford River (d on plan) the recent drainage of the country has formed new and more recent channels, leaving the pliocene gravels *in situ*.

For instance, in the creek below the Full Moon, these deposits (aaa on plan) are very extensive,

and, so far, have not been exhausted, as the drainge is difficult on account of the bar, over 40 feet high; but the ore is well distributed through this lake-like formation, at the northern and eastern margins of which the tin becomes scarcer, and is replaced by titaniferous iron: in fact, the tin ores disappear east of the line drawn on the plan. The same features were, in a minor degree, observed at *b b*; but at *c c* these deposits were very rich, and they occupied a large area of ground only partly workable, on account of water.

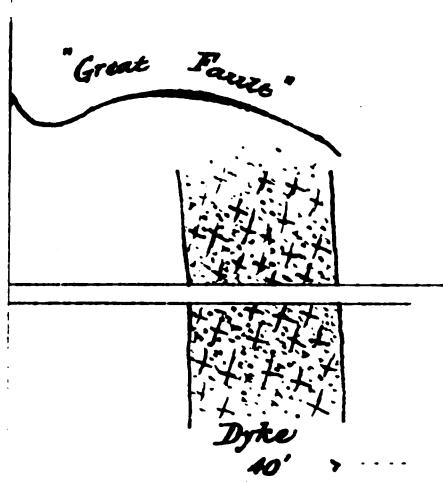
With regard to these "pliocene" deposits of tin ore,—occurring as they do in a fine gravel of quartz nearly of uniform size, and the absence of any fossiliferous leaf beds by means of which they could be classified for place geologically,—it is somewhat doubtful whether they are not of marine origin, of a formation when these parts were submerged beneath the sea.

The recent (pleistocene) deposits, as the result of the wearing away, decomposition, and subsequent denudation of the lodes and dykes described in this Report, are not only very extensive in filling all the water-courses in their vicinity, but also have enriched the principal rivers taking their rise at the blue Tier. For instance, the following heads of rivers and their tributaries were examined, which though consecutively worked for eight years, have yet a deal of profitable tin-wash left in them.—viz, the Ransom, Wyniford, Frome, and Weld Rivers.

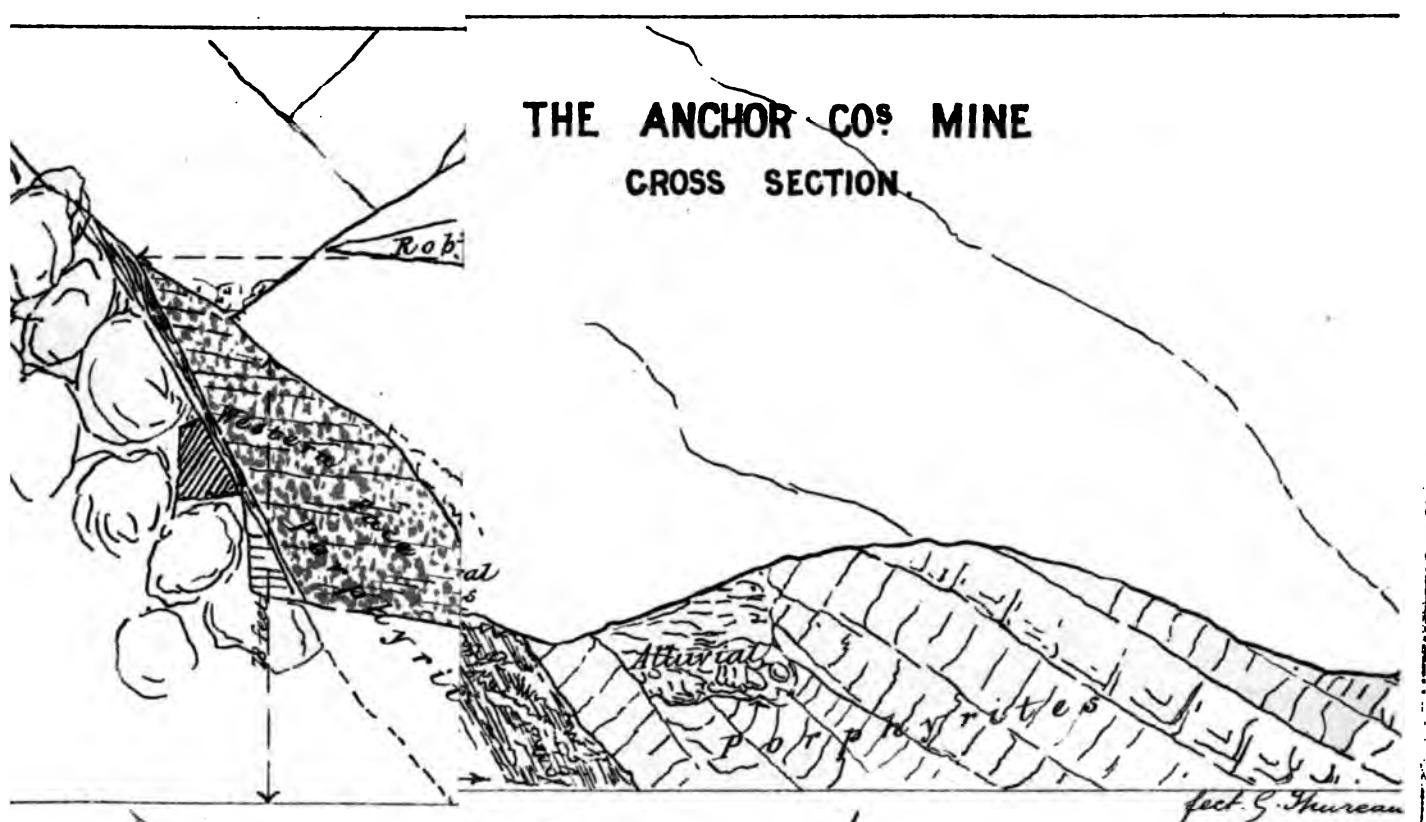
What appears to be a very extensive tract of unexplored country was seen between the Lower Junction township and Weldborough (Thomas's Plains). The pliocene gravels, as disclosed in the flanks of the mountains and in the cuttings for the main road north of the Cambria leases, are overlaid by thick sheets of basalt, and, as it is a well known circumstance that several rich alluvial (tin) creeks take their rise (see plan) east, north, and west of same, there is every appearance of an extensive sub-basaltic pliocene stanniferous deposit occurring there not yet touched by the miners. It would be useful, and in the direction of opening our mineral resources, if a thorough practical and scientific exploration of that "unknown country" was undertaken by the Government, the expenses for which would, by all appearances, be soon reimbursed to them from the income derived from the miners, who would, if my premises were found correct, of which there can scarcely be any doubt,—as proved in the very similar discovery of the sub-basaltic tin "lead" from near Brothers' Homie towards the Pioneer Claim, Ringarooma,—soon take up the land for energetic and extensive mining purposes.

In concluding this Report on the Blue Tier Mining District, and taking at the same time a comprehensive view of its many and quite undeveloped tin ore deposits, it will be consolatory to find that although the erewhile so easily obtainable alluvial deposits have been nearly exhausted at the Blue Tier proper, there remain others of the same class not yet touched, and also others of an extent, permanency, and value which, if at once subjected to systematic mining operations, would give to this district that settled mining population which all permanent mineral and metalliferous deposits contrive to do, and thus settle the district for a long time to come. The only two drawbacks at the Blue Tier have been, and are now,—firstly, that it has suffered from the same intermittence in mining operations as the rest of Tasmania, arising from spasmodic attempts by speculators to float worthless mining ventures, and from excessive market operations, superadded to mismanagement; secondly, the want of a regular and copious supply of water; but that difficulty is gradually disappearing with the progressive exhaustion of the alluvial tin deposits; and if the present owners of mines in this district would take full advantage of the very favourable conformation of this mountainous country traversed by deep valleys, and adopt a general system of driving deep adits in such localities as nature has provided in contiguity of lodes and dykes, there is, in my opinion, ample scope for the initiation of a to-be-maturely-considered scheme for unwatering those stanniferous formations to great depths at moderate expense, and then to work the same on a comprehensive system by means of several main adits. This would also reduce the present difficulty and the expenditure necessary for bringing down the cleansed ores from high altitudes, as the mouths of the adits would necessarily be situated at much lower level.

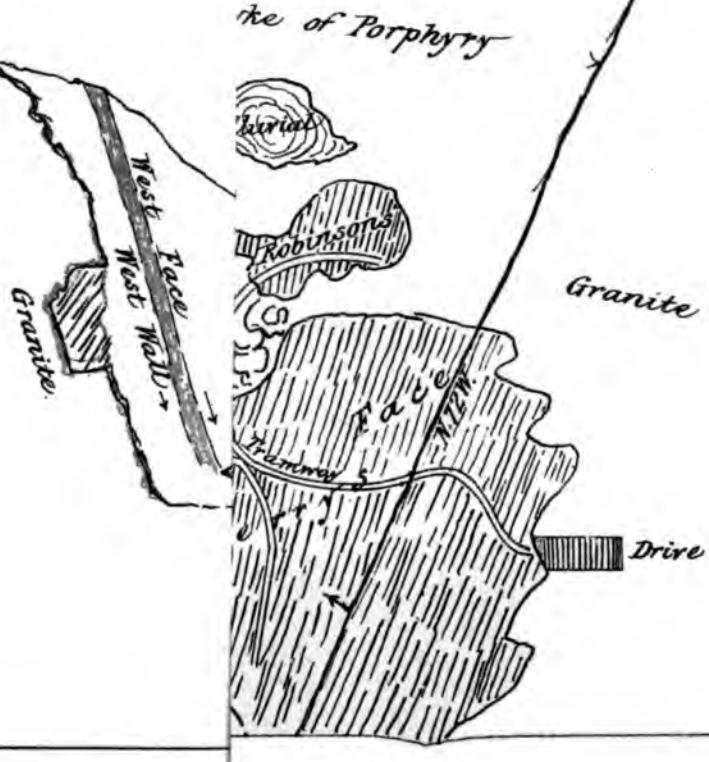
G. THUREAU, F.G.S.

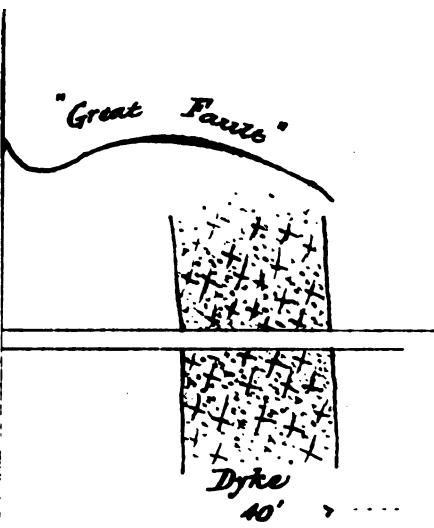


PLAN N°2.

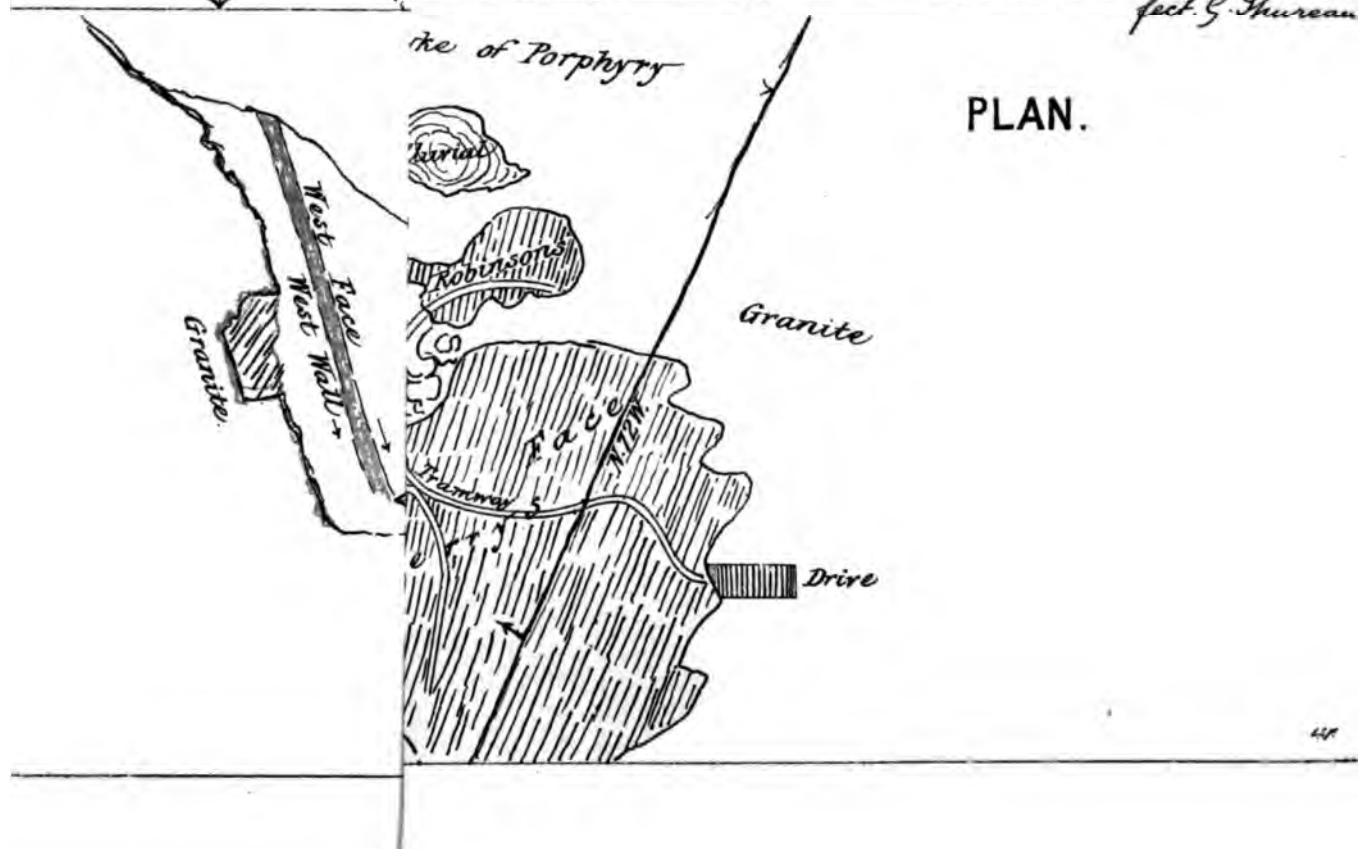
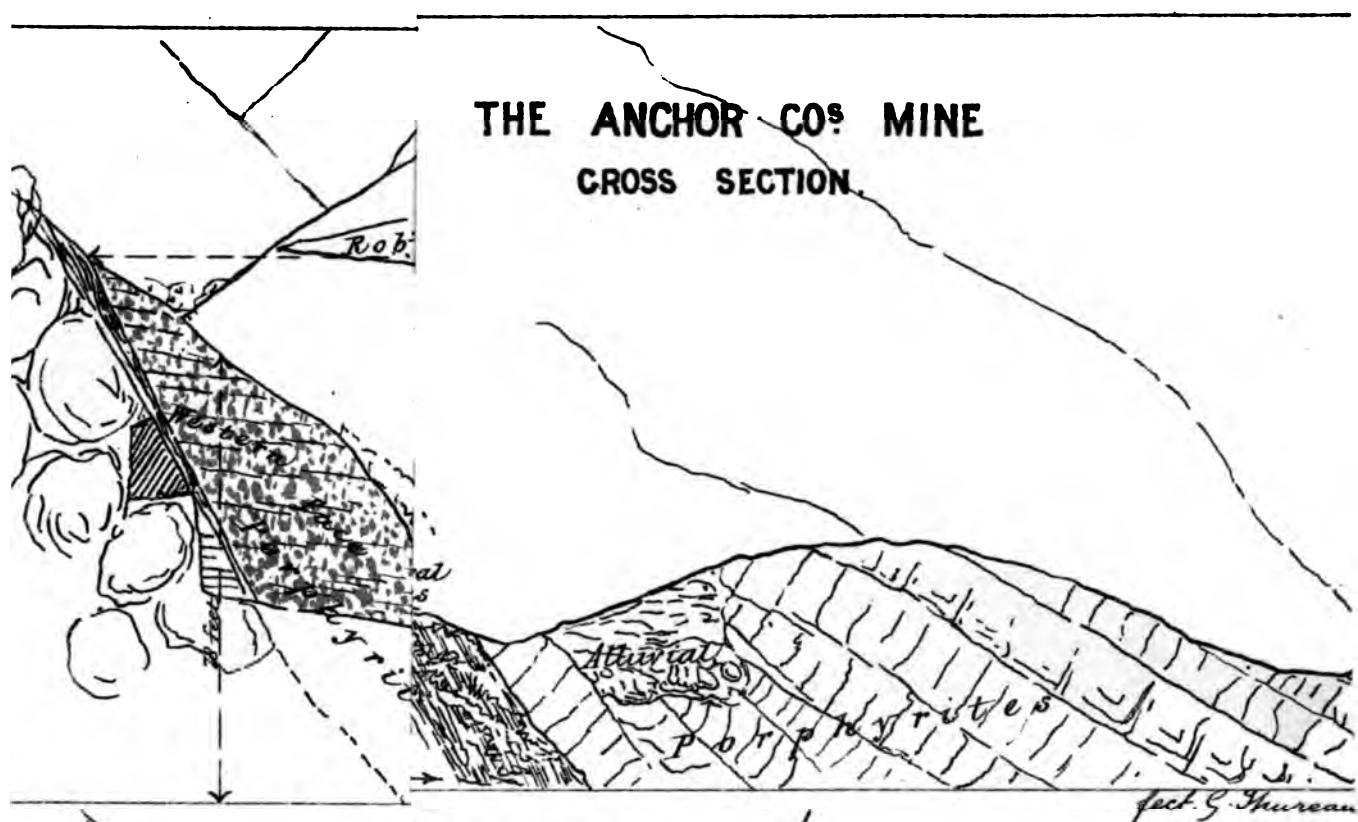


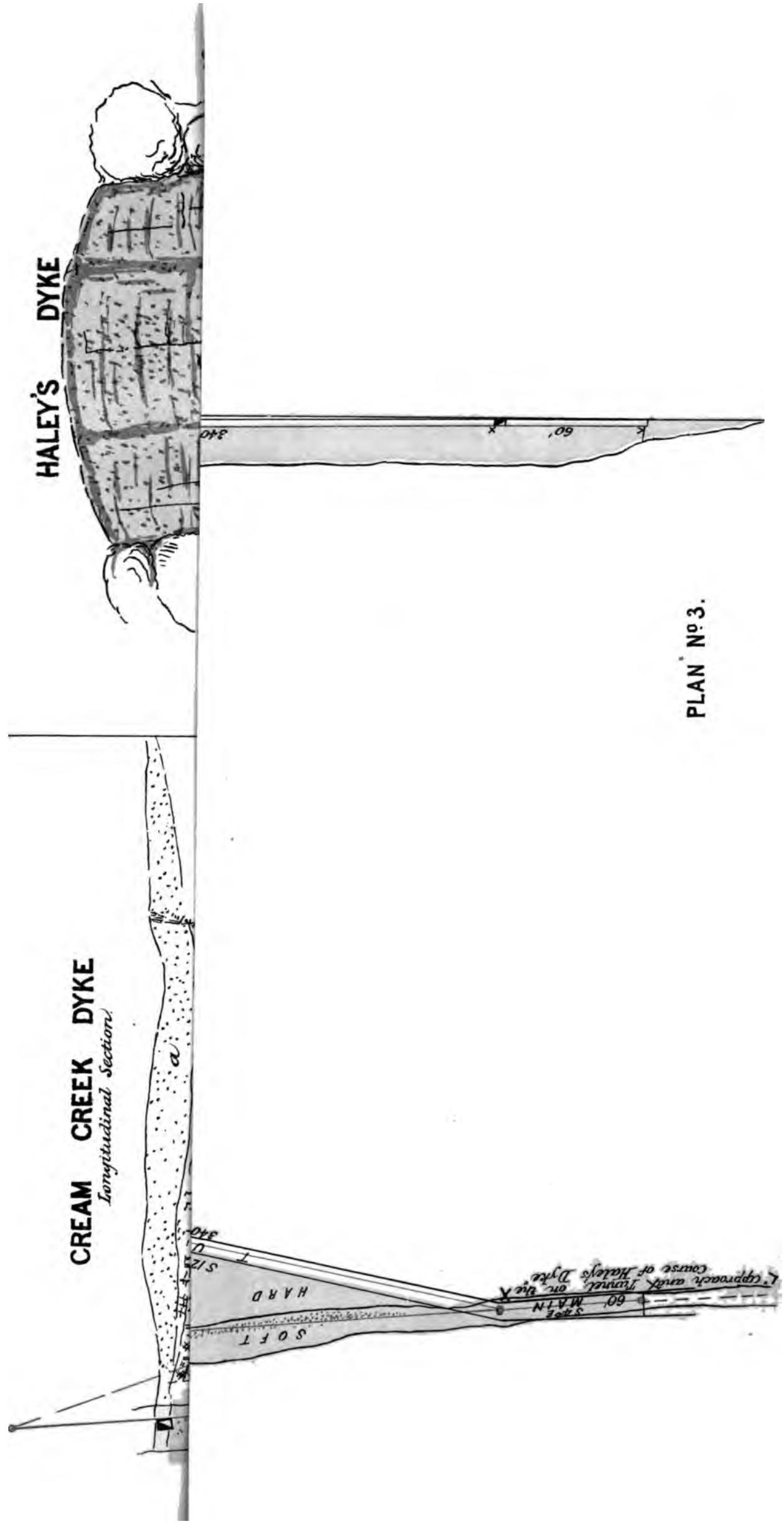
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PLAN N°2.







Inspector of Mines Office, Launceston, April, 1886.

REPORT on the Scamander Silver and Gold Deposits.

THE existence of some metalliferous deposits in this vicinity has been known for some years, but, as they occurred on land alienated from the Crown, some difficulty was experienced in obtaining permission for their exploitation. A few months ago, however, Mr. J. R. Chaffey obtained a lease of over 600 acres for mining purposes from Mr. M. Steel, and no time has been lost in testing in a practical manner this promising locality.

The locality where the silver-gold deposits have since been found to occur is highly interesting from a mining geologist's point of view, both on account of their established value and of their similarity to other older and well-known silver-gold vein deposits in California, Nevada, and in the Colony of Victoria, which, like these here, chiefly occur in dykes of porphyry and in metamorphic schists.

The dyke of porphyry (quartz) in which these silver-gold bearing veins are enclosed, observes an average bearing of N. 24° W., and its width appears as contingent on the country rocks, through which it protrudes in its course on both the north and south side of the river, being from one to five chains in width, the greater width being observable in the schists and not in the granite (see geological sketch plan). South of the river this dyke is, at a distance of about one mile, overlaid by the marine tertiaries, and in the north, across the river, I have traced it for over three miles without reaching the end, where it crosses the most southern foot hills of the Scamander Ranges. There is, therefore, ample scope for prospectors in this direction, as very little private land intervenes from those ranges to the George's River and farther. Indications of another and parallel dyke west of this one were observed, and other ore deposits may occur, as this region has not been much prospected, though gold has been found in a thin vein north of the river and west of the township of Yarmouth. This dyke of porphyry being of a more recent origin than the granite and the schists,—the latter on both sides of same,—dip anticlinally from that plutonic rock, which thus forms the axis or "centre of division."

The mining operations which have been carried on under the direction of Mr. Chaffey upon Mr. Steel's land are located and extend almost from the southern edge of the Scamander River for over six chains to the south; beyond that principal deposit other promising indications have been found on or near the surface. Several surface cuttings along the "cap" of the various veins have been made, and a tunnel had been driven at nearly right angles with the course of the dyke for a distance of over 80 feet, intersecting thereby not only the irregular veins met with in the surface cuttings, but likewise others not so exposed to view.

The character of these silver-gold veins is very characteristic, as they differ very materially from those, for instance, recently opened at Silverton, Broken Hills, and Sunny Corners, N.S.W., where chiefly pure chlorides and sulphides of silver and also galenites are found to occur in purely mineral-bearing veins of chiefly a ferruginous (*gossan*) character or description. The Scamander veins consist, however, principally of quartzose vein matter, in the joints, cavities, and cracks of which their silver ores occur in botryoidal cluster-like forms, and in small concretions coating the quartz crystals, and as thoroughly associated with iron and arsenical pyrites. The silver ores proper exhibit a splendid lustre, when approaching crystallisation, in yellow to amber and greenish to grass-green or olive colours, which latter do not fade on exposure to the atmosphere. Comparing these ores with the chloro-bromides (*embolites*) of silver of St. Arnaud, Victoria, and with those of other renowned silver deposits in South America and Arizona, there appears to be a marked difference which, together with my tests, would place them as "bromides" of silver or "bromite," which occurs in nearly all of those places mentioned as associated with chlorides of silver and also of "cerussites" (carbonates of lead), the last of which I discovered in very fine needle-like crystals. All these kinds of ores carry, generally, a very high percentage of silver, which, at Scamander, is much enhanced in value by the occurrence in these veins of free gold.

With regard to the width and extent of these veins, it may be stated that in the adit referred to they range from about six inches (the first vein carries a good percentage of visible native silver) to over four feet thick; and it appears from their bearings (of four of the veins) as if they would intersect each other at various points, thus forming an extensive vein formation in the porphyritic dyke, which circumstance should in the future greatly facilitate the mining operations on a larger scale.

The assays, as made from time to time, and from various veins, by Mr. Jenkins, of the Mount Bischoff T.M. Smelting Works, have ranged from 20 ozs. of silver and 8 dwts. 9 grs. of gold to 198 ozs. of silver and 9 dwts. of gold to the ton of raw ore, which undoubtedly should leave a very profitable percentage over all working and other expenses when working or manipulating the ores in the manner described below. It should be borne in mind that, as this ore occurs exclusively in quartz, thus representing a very high percentage of silica, it will be quite impossible to smelt this ore with any degree of success in the modern "water-jacket furnace" (La Monté's), owing to the absence of the necessary and cheap materials for liquefaction so as to produce in such furnaces a good flux in order to separate and concentrate the metalliferous from the earthy ingredients in the ores. Quite recently such a furnace, of 20 tons capacity, was purchased by the New Zealand Smelting Company at Auckland, for the purpose of treating the vein-matters of the Thames reefs, which, to a certain extent, correspond with our Scamander ores as to their relative percentage of silica; but they are richer in free gold of a low value owing to the large percentage of silver contained. Mr. La Monte asserted, and the company accepted his statements as correct, that by means of his furnace 90 per cent. of the assay value of gold and silver per ton would be saved; that the cost of treatment would be at the rate of £2 per ton, and that the capacity of his furnace was at the rate of 20 tons per diem; and the results of a thirty days' run were as follows:—The estimated yield of 90 per cent. was reduced to one-fourth; the treatment cost £6 15s. per ton; only six tons were treated per diem instead of 20 tons, and the 30 days' run cost the company £1227 5s. It appears that La Monté based his original estimate too high, and he did not anticipate the very serious difficulty that had to be met with in the *excessive proportion of silica* in the Thames ores. The amount of flux required was, of course, very great, thus reducing the quantity of ore treated to about one-fourth of the original estimate. Where no silica (or quartz) occurs, of course, very much better results are obtainable with proper fluxes in these or similar furnaces, but, as shown above, they are not at all suitable to Scamander ores as occurring at, above, and, in all probability, for some distance below the present adit level.

The Scamander ores resemble very considerably those I have examined in the mines of the States of Nevada and California, and also those from Arizona and Mexico, where they are now manipulated to such a degree of success as to give up from 65 per cent. of their metallic components, which is considered by their experts to be as near as possible the real value of the ore obtainable; and this is added to by the annual results after other manipulations and further treatment of the tailings resulting from the processes employed.

The following is a concise synopsis of what treatment should be employed with the very considerable quantity of ores now in sight; viz.—

- 1st. Calcination; that in proper furnaces preferable.
- 2nd. Crushing with rollers, discs, or disintegrators to produce less slimes than with stampers.
These to discharge into
- 3rd. Collecting sand-pits. Sands to be fed into
- 4th. Grinding pans (horns), to reduce the ore fine enough to admit of its being treated in the larger
- 5th. "Separating pan," revolving at a lower speed, and which can be hermetically closed, but by means of valves can be made to admit of superheated steam near its base, through an annular steam chest to heat the pulp, and jets of quicksilver from the top of this concentrator.

The resulting tailings are to be intercepted and left to decompose in the open air for further treatment.

In the States referred to, the *pan process* entails a cost per ton of from £2 6s. to £2 18s., which amount would be materially reduced on account of the lower wages prevailing in this Colony. The employment of pans and separators, as the character of the ore does not admit of any better system of concentration, appears at first sight to be, in connection with the use of quicksilver, somewhat inexplicable, as mercury will only associate and amalgamate with pure metals. The Scamander ores, however, contain but free gold, and the silver occurs either as a bromide or sulphide (stephanite), but it has been proved, and the manufacture of these sets of pans,—viz. two grinding and one separating in each set,—has received in those States a great impulse from the fact that no better results could be obtained by any other means or process, and that their ores were peculiarly well adapted to working in such vessels; and the chemical composition of the Nevadian, Californian, Arizona, Mexican, and Scamander ores is such that the iron of the pans to a sensible degree assists their decomposition. Under proper treatment, *i.e.*, including additions of solutions of sulphates of

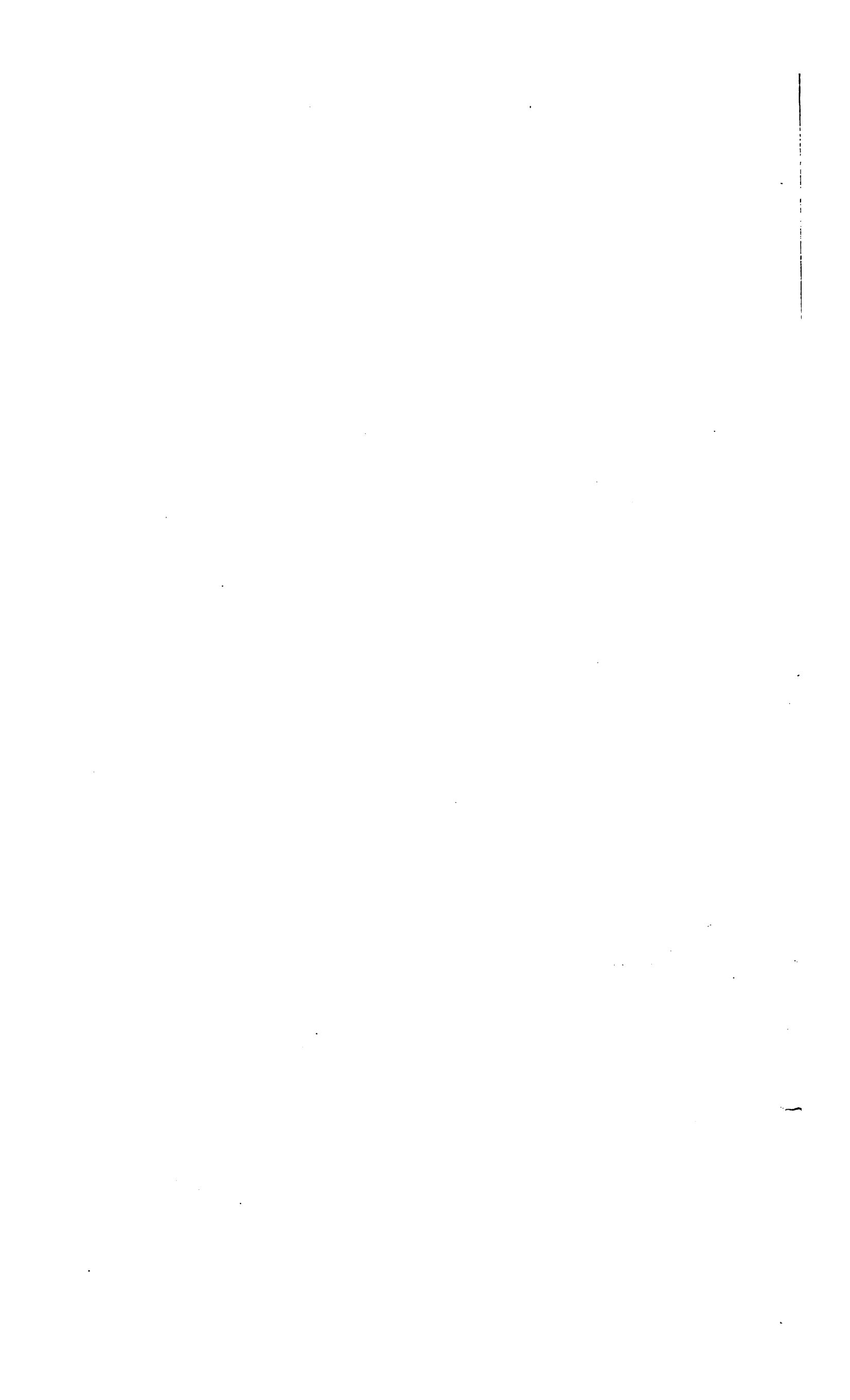
iron and copper periodically, these ores will be readily, with the aid of the particles of iron worn off during the grinding processes, made to give up their silver contents in a metallic form for proper amalgamation. The "separator" or "pan," which is much larger than the two grinding-pans, but all of which are occasionally fed with mercury, revolves at a lower rate of speed, and in it the "pulp" is from time to time considerably diluted with water, causing the quicksilver and amalgam to fall to the bottom, whence it is removed for retorting in a furnace, which is furnished with a number of shelves (iron) carrying each a number of iron forms for the ingots of "bullion," i.e., silver and gold obtained from the amalgam thus retorted.

As regards the permanency and extent of these silver-gold deposits, the former is, in my opinion, substantially proved from the general character of the veins and the laminated structure of same with the ores contained therein, with this satisfactory addition—that indications exist of these bromides of silver passing into, at lower levels, sulphides and sulphurets. As to the extent of these ore deposits, confined as they are to the dyke of feldspathic porphyry, it should be borne in mind that scarcely any indications whatever were existent at the surface of so valuable ore deposits beneath the same, and that more pronounced indications have been found both north and south of the river, where they are exposed at the lowest point near the river's edge. Quartz veins charged with sulphurets of lead, zinc, iron, arsenic, oxide of manganese, and a little silver have been found both north and south in the dyke for a length of over four miles at various places; and patient search, skilful exploration, and sinking to greater depths, where the country does not admit of that much more preferable mode of prospecting,—viz., tunnelling,—is only needed to prove their subterranean value by such methodical system of development.

A thin quartz vein (four inches) has been discovered by Mr. Chaffey north of the river, and west of Yarmouth. Assays showed 1 oz. 18 dwts. of gold and a considerable percentage of silver per ton.

G. THUREAU, F.G.S.

F. BELSTAD, Esq., *Secretary for Mines, Hobart.*



J.C. Branner.

GEOLOGI

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(No. 146.)



1886.

PARLIAMENT OF TASMANIA.

**THE LINDA GOLDFIELD: ITS AURIFEROUS
AND OTHER MINERAL DEPOSITS.**

REPORT BY G. THUREAU, F.G.S

Presented to both Houses of Parliament by His Excellency's Command.



THE LINDA GOLDFIELD: ITS AURIFEROUS AND OTHER MINERAL DEPOSITS.

Launceston, October, 1886.

Geological Features.

IT may be observed that, in adopting the above heading for this Report, I was influenced by the fact that the principal gold deposits do not occur on Mount Lyell at all, but on a spur running northerly from Mount Owen, the eastern flanks of which spur are drained by tributaries falling into the Linda River, and these watercourses have been found gold-bearing, whereas similar tributaries on the western flanks of Mount Lyell empty themselves also into the Linda, but so far have not produced any gold. Mount Lyell proper occupies a position within the junction of the Linda with the King River (see chart) and easterly of Mount Owen; and it may likewise be deemed advisable to state that the crests of most of the prominent mountains comprising the Western Cordilleras of Tasmania, and named after eminent men of science, are not composed of quartzites or other allied rocks, but are invariably capped by massive beds of coarse conglomerates which overlie several hundred feet in thickness the quartzites and other metamorphic schists. It is a question whether these conglomerates belong to the Silurian era, as the angles of their dip average from 25 to 40 degrees only, and true Silurian slates and sandstones at lesser altitudes observe an inclination of from 65 to 80 degrees. These latter on approaching the sea coast are represented in auriferous country, and I found the first petrification on the West Coast in the same. These beds invariably dip to the west (whilst the former, conglomerates, dip all to the south), but in themselves they exhibit (as shown in the sidlings) both synclinal and anticlinal sections. At the road camp half-way between the King River G. M. Company and the Linda goldfield, green-stone (diabase) rests immediately on the barren quartzose schists, whilst the country towards that gold mining claim has been protruded by several dioritic dykes, and the Silurian schists in that vicinity have become distinctly metalliferous, as several gullies (Lynch's Creek) falling into the Queen River have been wrought with sometimes considerable success, and in several instances their hackly and quartziferous gold has been traced up to auriferous quartz veins, upon which all operations had to cease on account of the impossibility of transporting crushing machinery by means of the mostly impassable tracks, which are now only being improved tardily, and a road made from Long Bay, Macquarie Harbour; this fact has more than anything else retarded the development of a large and evidently very rich gold and mineral district, as alluded to below.

In numerous instances fine samples of rich gold were shown as coming from a wide area of country, embracing Mount Sorell in the south, where, at Flannigan's Creek, the recent alluvial is paying well, and Hall's party are working an old pliocene channel 600 feet above that creek with marked success. Going north several miles south of Mount Owen, an "Iron Blow" was discovered, with some gold in the gullies, but owing to the difficulty of getting supplies there it was abandoned. Then we have the Linda goldfield proper, which, besides its famous "Iron Blow," should support a large mining population if water could be made available all the year round. All the gullies "fed" by the Iron Blow on the west of the Linda River would have been payable or rich if the claims had a large supply of water and a good pressure to hydraulic the beds of gravel, over 70 feet in height in places. Crossing the northern connecting spur of the Mount Owen and North Mount Lyell—under which Watson's alluvial claims are located, and which at the higher point have produced the heaviest quartz gold in this locality (one exquisite specimen, fit for any Museum, weighing 6½ ozs., of which about 4 ozs. was pure crystalline gold)—several gullies and older deposits (Evert & Co.) have been worked with great success, as falling from that divide into the Queen River. Still further north, at Mount Sedgwick, it was reported to me that an auriferous Iron

Blow had been found ; also still further away similar deposits occurred at the head of the Henty River ; then crossing the Pieman River, in the upper forks of the Meredith River, under Mount Livingstone, land has been taken up on a similar formation ; then, as is well known to me, an "Iron Blow" occurs at the Rocky River, where the largest Tasmanian nuggets were found, which, it will be remembered, were considerably encrustated by iron ores ; and lastly, "Iron Blows" occur crossing Long Plains, and in the vicinity of Specimen Reef.

For two or three years past I have had my attention drawn to the ferruginous character of the gold found across Long Plains towards and beyond the Whyte River, and this discovery of the "Iron Blow" at Linda may, it is earnestly hoped, be the precursor of other and as valuable discoveries. In several localities, for instance, payable gold has been traced up creeks and gullies until an intersection took place of a mass of iron, whereupon the gravels ceased to be remunerative, which in itself is a very suggestive feature if regarded in the light of the Linda discovery.

The Mount Lyell Gold Mining Company's Gold Deposits, Linda Gold Field.

These comprise a very extensive and, so far as they have been tested in the surface workings to a depth of a little less than 40 feet, quite phenomenally rich gold deposits, differing either in a geological or mineralogical point of view from any other I have had occasion to examine for a long period past, or that have been recorded by scientists in the mining world at large.

These deposits occur between metamorphic schists of a light colour at the footwall, and similar strata intercalated by quartizes and bunches of pyrites* at the western hanging-wall. The outcrop of the "formation"† disappears beneath, or is capped by a thickly bedded stratum of conglomerates and brown hard sandstones. The outcrop of what may be termed a huge fissure of this iron formation observes a strike of North 20° West, and it has been traced in that direction to continue at least for 1½ miles. For the whole of this distance it evidently maintains its auriferous character, as Cooney's, White's, Henry's, and other creeks, which fall into the Linda River (see sketch plan), have all been and are now producing very satisfactory yields of gold whenever an ample supply of water is available for sluicing purposes. The distance of one mile and a half has been mentioned as the limit to which this "formation" has been traced north,‡ but strong evidence exists to prove that it continues still farther north, because alluvial gold, or rather "formation gold," has been found in the hill sides and in gullies in very paying quantities. It may be mentioned that the gold thus found, both on the Linda watershed and on that falling into the Queen River, is of a very fine character, and of a similar description throughout, and not waterworn. The gullies referred to are situate from 3 to 4 miles north from the Mount Lyell Gold Mining Company's prospecting and reward areas. As a matter of fact the gold is of such a uniform description as would point to only one source, viz., the disintegration and decomposition of the "formation" at the surface. The surface outcrops of this "formation"|| throughout are characterised by the occurrence of a very little quartz of a wavy character, *baryta* taking its place predominantly. These singular deposits consist, at or near the surface, of immense blocks of bluish black iron ore, exhibiting in places a kind of stalactitic structure (hematite), but auriferous to a degree ; some of these blocks exceed 15 to 20 tons in weight, and through being sundered, from atmospherical action and denudation, other and smaller fragments compose a very massive outcrop ; others, again, have been left by further denudation on the hill sides, or found resting-places in the alluvial gullies below. On the south side of Cooney's Creek the Mount Lyell Gold Mining Company are enabled, from the steepness of the hill, to obtain "backs" from the level of their camp for a height of about 350 feet at the south end of the outcrop ; considerably more height of stopes can be obtained north of Cooney's Creek up to the "Iron Knobs," which characterise Mr. Curtain's section in that direction ; so that it is very clear that extraordinarily large quantities of gold-bearing ores are available for systematic mining operations, and subsequent treatment for gold extraction. At the level mentioned the quantity of ore is no doubt large, and can be obtained by means of adits ; if, however, a site is chosen some 20 or 30 chains lower down towards the Linda River, then it is quite evident that an almost inexhaustible supply of ore can be got for manipulation. The longitudinal extent, great width, and present visible height of these gold-bearing deposits being so very satisfactory, it only remains for me to describe the composition and width of this unique gold "formation," in order to permit the authorities and the general public to arrive at something like an estimate of the capabilities of this, our latest and—so far—richest gold discovery.

It appears that Messrs. Crotty & Co., having discovered "free gold" amongst the conglomeratic gravels and iron blocks on the northern slope of a spur descending from Mount Owen, sluiced away the surface deposits, leaving the larger blocks behind, some of which were subsequently found to be gold-bearing, to a depth of from 2 to 6 feet ; and though, owing to the extreme fineness and lightness of this gold, fully 70 per cent. must have been lost owing to the crude appliances

* When the word "pyrites" is used in this report it means those of iron.

† The "formation" here alluded to refers to Crotty's discovery of the "Iron Blow," or Blue Iron (auriferous).

‡ I found the first gold on Mr. Curtain's section, 1½ miles north of Crotty's discovery.

|| In my opinion, as explained further on in this report, these so remarkably interesting and very valuable gold deposits do not come within the category of what is understood as "lodes" or "reefs" by mining geologists or miners.

in use, the heavy "pitch" adopted for the sluice-boxes and the rush of thick water, still some 4 to 500 ozs. of gold were obtained since their discovery. I was shown a piece of ground which had been sluiced in this manner, measuring but 30 feet square by an average depth of only about 3 feet 6 inches, which had yielded over 100 ozs. of free gold, as much or considerably more being carried away by the water as detailed above, or left in the disintegrated, hard, and ferruginous residues, which there rest on beds of pure iron pyrites of very considerable extent and unknown thickness. It may also be stated that these surface workings, in which gold can be seen everywhere, especially after showers of rain, which are very frequent in that locality, extend for a length of over 300 feet along the strike of the formation, and for a width of 57 (fifty-seven) feet for the richest ores, and not less than 3½ chains in width additional (actual measurement) of solid iron pyrites, which latter I regard as gold-bearing, notwithstanding certain assays indicating so far to the contrary.

The various Plans and Sections accompanying this Report will not only be found of good service, but may be relied on as tolerably correct, considering the time, weather, and journeys I had to pass through.

The "formation" is shown at the "eastern footwall," both in an open cutting and in a short tunnel, sufficiently to permit bearings to be taken and the underlay of same to be ascertained; at the opposite, or hanging-wall, the observations are not so facilitated, only a partly fallen-in tunnel admitting of such to be done. After carefully examining the deposit between its two walls, and in all the open surface workings, I became convinced that it presented not the slightest resemblance or similarity to any lodes, reefs, or even dyke formations that I had become acquainted with during many years past, inasmuch as the metalliferous and mineral "contents" of the "formation" do not in any way or manner assimilate with any of those vein deposits or dykes.

Immediately beneath the "Iron Blow" or blocks of iron ore described above, a variety of more or less gold-bearing minerals occur, which are quite unique in their respective characters, and in which gold has not hitherto been found in Tasmania, nor, with the exception of one mineral,* elsewhere. These minerals require, therefore, great attention, study, and knowledge, in order to enable one to ascribe to them their proper place in the classes comprising metalliferous and mineral deposits; to trace the whole of them back to their origin, and thus support a theory I have formed, will fully meet the case.

As the question of origin of these singular deposits forms an important matter when engaged in determining their permanency or the opposite, I would offer the following remarks on this subject. In my opinion, based on very careful examinations, the so-called "schists" or "slates," whether of the "auriferous micaceous iron" or "hydro-mica" kinds, which are here so richly permeated with very fine gold, are simply "volcanic muds" thrown up by some kind of hydrothermal action at periods in the geological age which cannot yet be ascertained from the confined area I have been able to survey, and which I submit should be extended at as early a date as possible. Their slaty cleavage is doubtless due to vertical pressure, as a very great height of this formation has evidently been denuded during pliocene times, and also lateral pressure from contraction on these hydrothermal centres gradually becoming less and less active as their subterranean passages and super-aerial vents became closed up until a last emission of baryta had taken place. The gold was probably held in solution, or ascended with the volcanic mud in the form of a vapour, returning, as explained below, to its solid metalliferous form on a reduction of the temperature taking place near the surface.

The eastern footwall underlies at an angle of 64 degrees west, and the western, or hanging-wall, inclines in the same direction at about 75 degrees. Although these walls are fully 280 feet apart, the "formation" they inclose differs in every respect from any other in Tasmania, and stands in bold contrast with any other elsewhere. Taking off 3½ chains of solid pyrites along the western hanging-wall, we have still over 57 feet of "rich" ores along the footwall. This formation has been named by several persons claiming to be experts as "auriferous micaceous iron schists," also "hydro-mica schists," "iron blow," and "blue iron;" but after having carefully examined the whole of these deposits, I have come to the conclusion that those convertible terms, so extraordinary in their kind, do not come within the definition of "schists" at all, although a kind of semi-stratification can be observed. There are no laminations or bands, and a total absence of linear persistence, as one would expect to find with a lode or similar mineral formation of any sort, and the whole formation, with no quartz to speak of, exhibits a very strong deposit of iron pyrites, chiefly of a very dense character. The principal portion and richest in gold of this deposit is of a dull mauve colour, in which the gold is thickly disseminated†, although principally in the finest particles, up to pieces several pennyweights in weight. These larger ones present a leaf kind of form, evidently as if resulting through pressure into the crevices of this solidified volcanic mud. This very peculiar kind of ore, which easily falls into a fine blackish powder on handling, is a kind of fine soft "tufa" semistratified through the simultaneous(?) or subsequent interspersion of baryta, which, after cooling

* Baryta, which, I believe carries gold in some of the Queensland mines.

† The black powder of this mauve-coloured rock gave an assay of 187 ozs. of gold per ton, I am informed by one of the owners.

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assumed a lamellar form, thus producing a kind of cleavage in this otherwise amorphous rock. In volcanic countries sublimates of sulphur or chlorides can be and are being formed, or the sulphuretted acids—decomposing pyrites—give rise to gypsum, which spread in a network of threads and veins through the hot, steaming, and decomposing mass. If “baryta” is substituted for gypsum, this would exactly apply to this formation.

The apparent semi-stratification, therefore, appears partly due to the intrusion of baryta in volatile forms as well as to carbonic gases, which latter, in all probability, precipitated this fine gold within cooling influence nearer the surface, and partly to lateral and vertical pressure.

Extract from an eminent modern mineralogist's work, in which the deposits of “sinter” (a silicic deposit) are treated, and which process closely assimilates, although the products are different:—“Around these geysers and mud volcanoes ‘sinter’ is no longer formed, and, their surfaces exposed to the weather, crack into fine shaly rubbish (powder) like comminuted oyster shells.” This latter feature can be seen in some instances in specimens in our collections.

Baryta, it may be stated, and its components, when moistened with strong solutions of nitrate of cobalt, give before the B.P., in the O.F. flame, a brown bead, which, on exposure to the air, breaks up into a darkish grey powder, thus substantiating what has been averred of these volcanic muds; and that, on the exposure of this compound, the baryta causes the production of powder rich in gold, especially so when the former maximum intensity of these heated chemical reactions, when in a state of activity, are taken into consideration.

That that activity was of a drastic character in this locality is proved by the occurrence in the same rocks, and in a parallel fissure of the “Iron Blow” some nine chains distant, of a zone of chiefly pure native copper, very productive in places, and well worth attention when it can be transported to Long Bay at cheaper rates than at present.

As regards the supposed presence of mica in this volcanic mud, I believe the surcharge of “specular iron” which abounds in this district, especially close to and in this “formation,” has been erroneously taken for the former mineral, and thus the “schists” (?) were assumed to be the right classification, and in all probability their peculiar mauve colour is due to admixture of manganese and iron with their various combinations.

The subjoined sketches of the various workings and the “faces” or “stopes” will, it is hoped, sufficiently illustrate the actual mode of occurrence of these “flat cone-like” bands of gold-bearing matrices, and it will be noticed—though *in loco* these features may, at times, not be quite so distinctly visible, and they require time and attention to discern the same—that the apices from either wall, on coming within the scope of the “vents,” become decomposed; especially is this the case in the pyrites bands from the hanging-wall side. In my opinion the presence of those massive beds of solid pyrites exerted a very great influence, whilst perishing, in the formation of the richer deposits by coming into contact with the intensely volatile substances held in solution in the centres of the vents, and which were vomited at the mouth of, in all probability, several centres of hydrothermal action.

Recapitulation.

I would here point out, that according to the theory adopted for explaining the origin of these most valuable and remarkable gold deposits, the following would indicate the successive periods of auriferous deposit:—

1. Formation, by volcanic and plutonic action, of huge fissures in an already gold-bearing belt of rocks.
2. Such fissures being immediately and partly filled by sulphuretted iron under pressure, by sublimation and injection from below, crystallising slowly against the hanging-wall.
3. The remaining and open spaces within the fissure were then in active volcanic action as mud-springs, cold, except within the influence of the intensified action within the central “vents,” throwing up periodically volcanic muds holding gold either in solution or in vaporised forms, when the then almost closed orifices after cooling were closed by a final discharge of volatile baryta, which it may be assumed caused, with the aid of carbonic and other gases, and very probably also of electrical action, induced amongst all these various ingredients held in solution at high temperatures, the deposition of gold in its present peculiar metallic forms. It was noticed that in these mauve-coloured gold ores there occurred frequently nodules of various sizes, but mostly of a flattened shape, composed at the outside of iron casings; these, I opine, were originally bubbles of gas filled with sulphuretted solutions or gas, and on the mud becoming more and more rigid they formed those nodules, in contact and in combination with iron.
4. The subsequent “inactive” or “dead” state of this whilom active deposit was as follows:—The massive iron pyrites were, to an insignificant depth, decomposed by the air and surface water,

charged with vegetable matter, into hard black (hematitic) iron ores, here and there to somewhat stalactitic; at greater depth they were changed into red iron ores (limonites), often enclosing nuclei of pure pyrites.

As regards the solidified volcanic muds, they more rapidly, on account of their more friable character, decomposed, and this contributed most, if not all, the alluvial gold at the hill sides and in the gullies and creeks.

Permanency.

In regard to the future *permanency* of these and other deposits, I find that, irrespective of the many thousands of from remunerative to rich ores in sight, in all the deeper workings the gold occurs as rich, if not richer, and as evenly distributed, than at the surface or shallower workings. The extent along the strike is so large, and the width, outside of the pyrites beds so unusually great, that, as found in other mining countries, we may anticipate with every confidence that these gold deposits will descend to very great depths, and thus be practically inexhaustible.

As regards the proper and perfect treatment of these ores charged with such fine gold, which have assayed, I am informed, from 15 to 180 ozs. of gold per ton, I submit that this is a fitting opportunity to observe that, in my opinion, the last test of about half a ton by the "chlorination" process at Sandhurst, Victoria, of at the rate of 15 ozs. per ton, cannot be received as altogether satisfactory,—firstly, because a qualitative analysis did not precede that mode of treatment in order to ascertain whether or not any deleterious ingredient existed in the ore, which, on becoming volatilized in the furnace, would enfilm the gold, and thus resist chlorination; secondly, that the residues or tailings were not all tested for any gold that might still be retained in such wastes. It would be far more advisable, from what I have seen in California and Nevada, U.S.A., that all ores should be previously analysed and assayed, and that technical manipulation should precede, in proper machines, with periodical additions of superheated steam, mercury, and certain chemical compounds, the chlorination process, which latter should be applied to both the concentrated residues and to the "wastes" also occasionally, as the requirements of the case may warrant.

Yield of Alluvial and "Formation" Gold.

The Messrs. Henry & Co., merchants, &c., of Long Bay, have favoured me with a Memo; viz.—They bought, in 1885, 400 ounces of gold, and in 1886, to the 22nd September, 550 ounces. Messrs. Harvey & Gaffney during the present year bought 251 ounces of gold; but both parties state that a considerably greater quantity of gold was taken away to the other Colonies. It has been estimated that the actual yield of gold from the Linda, Queen River, Lynch's Creek, and Mount Sorell exceeded 2000 ounces for that period. Amongst the gold known to have been obtained, the parcel from the "formation" of the Mount Lyell Gold Mining Company weighed from 4 to 500 ounces. When it is considered that water is always scarce in summer, and that the number of miners never at any time reached above 80, the following yield may be deemed satisfactory, especially as fully one-third of the time was taken up by them to pack their stores and supplies; viz.—

Messrs. Evert & Co. (two miners), three miles north of the "Iron Blow," obtained 109 ozs. during the last 12 months.

Messrs. Watson & Co. (two miners) obtained 80 ozs. of free and 20 ozs. of specimen gold in six to seven months.

Messrs. Zeplin & Co. (four miners) exhibited at the Launceston Mines Office 122½ ozs. of gold; time uncertain.

Messrs. North & Co. have done a great deal of work to prepare for hydraulicking on a large scale, and during the last six months they have obtained meanwhile 40 ozs. of gold.

During the last two years three parties of miners obtained from three gullies falling into the upper forks of the Queen River in the aggregate 480 ozs. of gold.

Mr. Hall and mate obtained at Mount Sorell, in an old gravel bed 600 feet above Flannigan's Creek, 53 ozs. in nine days, &c.

These returns of gold would be considered large and remunerative if the small number of miners employed at about half-time are considered. These prospectors think nothing of carrying from 60 to 80 lbs. each of provisions through impenetrable scrub, across deep rivers, flooded morasses, along positively dangerous sidlings; and strong looking men have succumbed after but a year's or so packing, and are but the wreck of what they were before, fit for but very light work.

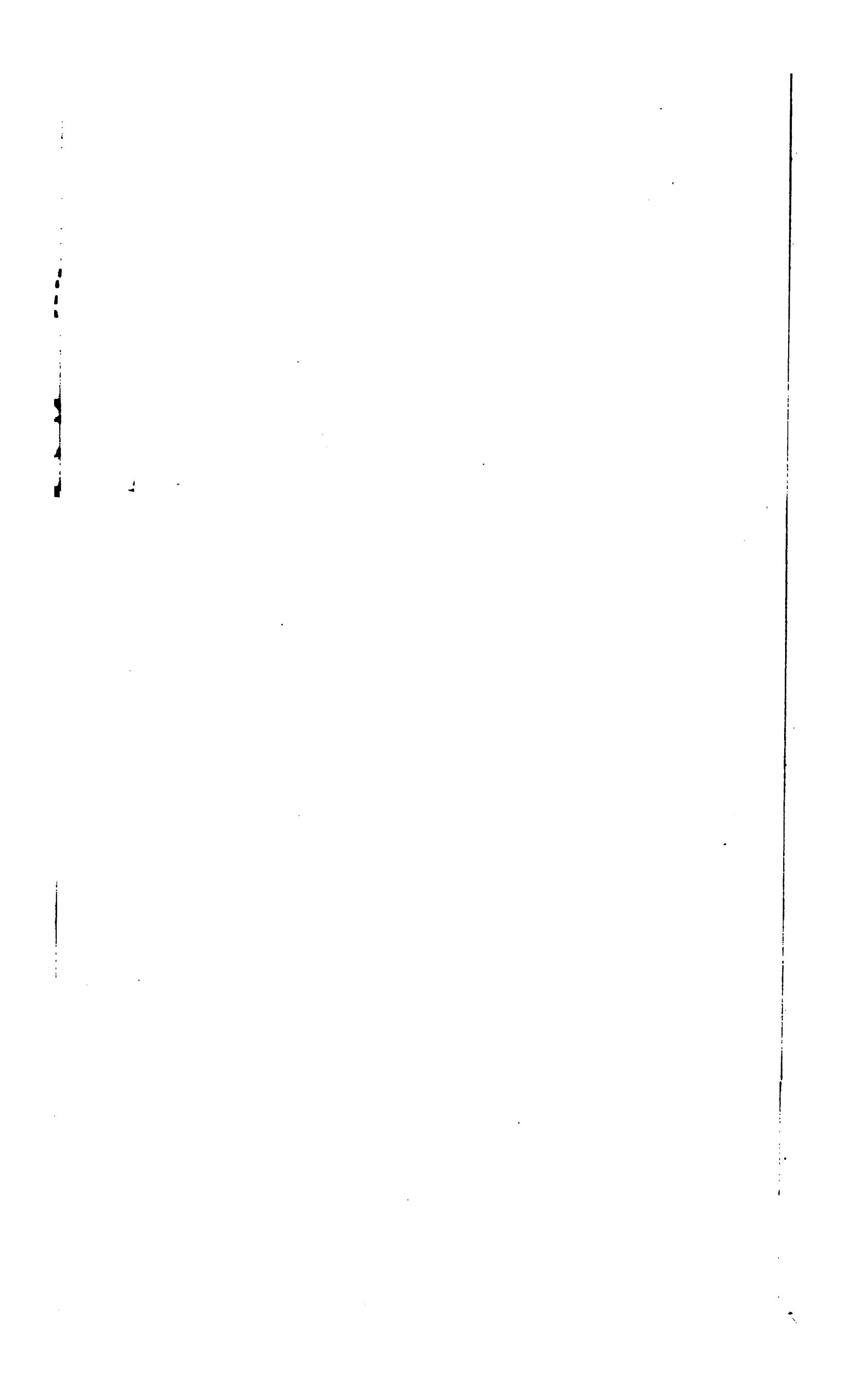
Besides gold, copper, chiefly found in its pure malleable state, occurs along a zone about 9 chains east of the original "Iron Blow." One vein measures twelve, and two others two to three inches wide. It occurs in quartzite, embedded in a kind of hard brown clay, and appears to account for the lumps of pure copper found in Messrs. Watson's claim, North Mount Lyell, weighing from 2 to 6 lbs each. Sometimes from 1½ to 2 lbs. of pure native copper can be washed in a dish.

Specular iron occurs in quartz veins; and compact, porcelaineous, hard magnesian limestone has been found 17 miles from Long Bay, near the track.

Requirements.

As the population is daily increasing, numbering at the date of my departure, the 29th September last, nearly 200 persons, as against 60 to 75 in 1885, the incessant traffic has cut up the road and tracks very considerably; and at least a hundred men should be put to work on the road from Long Bay in order to get the worst portions made this season.

G. THUREAU, F.G.S.





**MOUNT ZEEHAN SILVER AND ARGENTIFEROUS
LEAD LODES AND OTHER ORE DEPOSITS.**



PROGRESS REPORT on the Mount Zeehan Silver and Argentiferous Lead Lodes, and other Ore Deposits, in the County of Montagu, West Tasmania.

Mining Geologist's Office, Launceston, 14th December, 1888.

In the following Report it is respectfully submitted that it does not appear to be quite necessary to recapitulate here what has already been said in my Reports of last March, and over three years ago; consequently, this Report should be perused conjointly with the others. I therefore propose to deal now with the progress made since in the mining operations, the description of the principal new discoveries made by several proprietaries, the general prospects, and the wants in order to aid in the development of this extensive and very valuable silver region.

First on the list I place the Silver Queen Company, who have made good progress under difficulties, owing to the delay of delivery of steam machinery plant in order to sink to deeper levels, drain the mines of water whilst raising large quantities of rich ore. A main shaft has been sunk about 30 ft. from the surface, poppet-heads 40 ft. in height erected over the same, and a capacious feed-tank, 11 ft. 6 in. inside square measurement, constructed in connection with the upper brace. The main shaft measures 12 ft. by 3 ft. 6 in. in the clear, is strongly timbered, and divided into three compartments, two for winding and one for pumping. Besides this, three and a half acres have been cleared of its dense timber, in order to facilitate general operations at the surface. I descended, on the 29th October last, their lode shaft (all these works are situated on Section 1636M)—the deepest on this field—which had been purposely and very kindly kept clear of water, which is very heavy, for my inspection, to the 50 ft. level. The lode was found near the surface but a few inches wide, but it gradually, without interruption, increased to 3 ft. 6 in. in width at the above-mentioned depth. This in itself is a very reassuring and valuable circumstance, if regarded in the light of the permanency and extension to considerable depths of "lodes" on this mineral field. Another lode, 2 ft. 6 in., was intersected in this 50 ft. level crosscut, at such an underlay as to make a junction of both ore bodies lower down a certainty, which would then represent 6 ft. of solid rich ore. The ore is of a high percentage in silver, as has been proved by several assays, and from its appearance I am quite satisfied as to its proportionate commercial value. The matrix is very pure, solid, and of a permanent character; it consists of coarsish to fine-grained ore, streaky, i.e., antimonial, and "Fahl" ore.

New Discoveries.

On the same Section, 1636, a large formation (1 on plan) has been found, 14 feet wide, of which over 3 feet was good ore; from its mineralogical appearance and the course of its strike, N. 40° W., it is very likely to form the continuation of the Silver King Lode.

Another lode (2 on plan) exhibits a cap, 4 feet wide, of gossan, striking N. 47° E. On Section 1666M another massive lode was discovered, with a cap of carbonate of iron, from 3 to 6 feet wide, carrying good galena, striking N. 20° W., underlying about 55° westerly. An assay gave at the rate of 107 ozs. of silver per ton of ore. On the same section some branch lodes (3, 4, and 5 on plan) have been found, striking on the average N. 20° E., all underlying east. On Section 1643M three more lode formations were cut: the first, (6 on plan) 4 feet wide, bearing N. 28° E., and exhibits some chlorides and galena; the second, (7 on plan) 2 feet 6 inches wide, underlies east, carrying galena and some other mineral, which, unfortunately, I did not obtain a view of, but hope to receive specimens; the third (8 on plan) consists thus far of principally galena streaks and carbonate of iron, underlying east, bearing N. 35° E. On Section 1665, (9 on plan) a large lode formation has been discovered, over 10 feet wide, consisting of galena, carbonate of iron, and other minerals.

It will be now perceived that this proprietary has not only done solid work for the proper development of their first discoveries on the central section, but, likewise, they have never ceased prospecting on their other sections, resulting, from above concise description, very satisfactorily indeed. By so doing they have not only enhanced the value of their leaseholds, but have afforded additional and substantial proof for the Government that the limits of the extent of these mineral deposits have by no means been reached, and that the field is even now still extending.

Balstrup's new discovery, on Manganese Hill, is the practical result of a considerable amount of prospecting, in order to prove if argentiferous ores occurred, as I have intimated they would, beneath those huge blocks of manganese. Their persistent labours have now been rewarded by the discovery of a very promising and very rich silver lode near the north-western corner of their 80 acre Section, 1209^m. A narrow vein of manganese ore was found at the surface, which, on being followed by an open cutting into the hill, 30 feet in length, increased in that distance from 12 to 20 inches in width. An adit was then started, bearing S. 46° E. on the same, and, at a further distance of 62 feet, the now very compact and rich lode was found to be 4 feet wide, and is still widening; the underlay is west, at about 75 degrees. Throughout the whole length of driving the thickness was, at regular distances, ascertained as a control and for guidance. The matrix at first consisted of ferro-manganese, gradually becoming more and more quartziferous, thus producing its present laminated appearance. The ore contents comprise chlorides of silver, both green and brown, the latter more prevalent, indications of sulphides, and, in cavities, clusters of green crystals, mistaken for rich silver ore, but which I found to be "prase," a silicious mineral of no value. This now proved lode runs towards those huge manganese boulders mentioned above, rising over 350 feet above the adit, the country rocks being metamorphic schists and sandstones.

An assay made of ore procured from the end of the tunnel gave, I am informed, over 480 ozs. of silver per ton, which is, so far, the highest yield yet obtained in this Colony.

On Section 189/87^m the Silver Queen Extended Company is developing some very promising manganese outcrops of considerable dimensions, affording small but encouraging test proofs of silver. They have likewise opened two galena lodes. No. 1 on plan occurs as 5 chains apart from No. 2, and the former gave, with a matrix of 5 feet wide, a remarkably good return, viz., 173 ozs. of silver per ton. No. 2 is at present not well defined; it is 3 feet wide, and consists of a confused matrix of galena largely mixed with country rock, yet an assay gave over 100 ozs. of silver per ton.

On the line of the manganese country, but on the south-south-western slope of the hill, which descends to a tributary of the Badger River on Section 724/87^m under the name of W. Pead, additional manganese outcrops have been prospected, as well as others. One of these (1 on plan), has a very promising appearance, striking N. 23° W. This lode is over 3' 6" wide, and it evidently, owing to the now well-established valuable prospective character of manganese ores in this district, and its being in line with Balstrup's, only on the opposite side of the hill, and is, besides, of a very similar mineralogical character, and I was informed that traces of silver had been obtained from it. At No. 2 on plan, a metamorphic sandstone occurs, considerably impregnated with finely granulated silver-lead ore, which gave 81 ozs. of silver per ton on assay, and another, taken higher up the hill, 102 ozs. of silver per ton. Though these assays were, to some extent selected, owing to the ores being mixed with gangue or country rock, yet they afford, without doubt, good indications of richer ore deposits occurring if the ground were penetrated to greater depths, and every means should be employed to develop the same. Another ferro-manganese outcrop has been prospected 8 chains from the one first described, bearing S. 23° E.; and No. 3 lode on plan consists of a matrix of carbonate of iron and some galena, both of a very dense description.

On Section 735/87^m the Silver Prince Company have opened two lodes only; the bearings of *a* and *á* on plan are almost as identical as the description of the ores they are composed of, consequently I consider them as one and the same formation, though both places of operations are at some distance from each other. It exhibits a very regular and solid outcrop at both places, from 5 to 8 feet wide, and so for several chains along its strike of N. 15° W., and it takes the form of blocks which have a northerly dip, disappearing at times beneath overlying country rocks, but making again to the surface further on, and altogether it appears to be of a very permanent character. An assay of the very fair percentage of galena it contains gave 52 ozs. of silver and 77 per cent. of lead per ton.

The most remarkable lode, perhaps, even in this so diversified mineral district, is lode *b* on plan. To judge from the *débris* near the shafts and open cuttings—which were all full of water—the matrix is chiefly quartz, galena, and a large percentage of sphalerite—i.e., zinc blende, ochre, and a soft, friable mineral of a blackish-blue colour (argentite?). Assays made at various times gave the following results, viz.:—

| | | | | |
|----|-----------------|----|--------------------|----------|
| 77 | ozs. of silver, | 52 | per cent. of lead, | per ton. |
| 63 | " | 45 | " | " |
| 57 | " | 36 | " | " |
| 48 | " | 28 | " | " |

The last assay gave also a yield at the rate of one ounce one pennyweight and fifteen grains per ton of gold. The occurrence of gold from the peculiar kind of ore is new to Tasmania, but in California several mines yield something like it, and find that with depth the percentage of gold increases, and the bullion I examined there would, from a depth of 1300 feet, represent, besides the inferior metals, from 80 dollars of gold to the ton. Therefore, this company should not lose any more time, but at once resume active operations.

On the western boundary of No. 223/87^M Section of the Silver King Co., marked 16 on plan, and west of their main lode, a fine and compact body of pure silver-lead ore has been discovered; it is 16 inches in width, and it has been traced for nearly six chains on its strike, underlying west. To judge from its fine-grained character and purity, it should yield well in the smelting furnaces.

On a section west of Doherty's, the gossan indicated upon my plan of March last has been found, after superficial tests, to cover a lode formation, as predicted then, of a very promising character, containing carbonate of iron—that sure indicator of galeniferous ores in this district—and zinc blende. All that appears to be wanting is depth.

Other Mines.

The Silver King Co.'s principal shaft has been sunk about two feet since my last visit, and is about 14 feet vertical from the surface, and at the bottom there is still a splendid solid lode of ore from five to six feet wide. This same lode has now been traced eight chains north and two chains south of this shaft, unlerlying west. It has also been found on Section 804/87^M, held by the Silver King Extended Co., in a formation of carbonate of iron with small veins of galena 15 feet wide. In the south, on Section 222/87^M, it was also found, six chains north of Section 480/87^M: and thus good evidence has been obtained for this main lode extending over a very considerable area.

There cannot be any doubt but that, as a preliminary, a proper main shaft should be sunk without any delay west of their principal lode-shaft, in order to raise ore as soon as possible.

On Section 480/87^M, the Silver Bell Co. have bared their fine lode fully 6 feet in width. The underlay is to the west at about 60 degrees, and they are now sinking in the footwall an underlay shaft 18 feet deep at an angle of 65 degrees; thus, the further they sink the greater will be the distance between the bottom of shaft and the lode. The lode evidently dips southerly, so that their main tunnel, commencing at 14 chains from the Silver King boundary in the north, must be driven a very long distance for the "cap," and it will be useless for practical work, as it can command but a little over 30 feet of backs.

On Section 196/87^M the Silver Spray Co. have discovered a new formation, which I could not see this time. In fact, most of these discoveries were surface outcrops, are very similar in every way, and if not specially massive or rich could well be left to future examination. Though it was well known that for days I was in the district, and I made a list of companies applying for inspection, yet on the last day they wanted me to see something new when my arrangements precluded me from complying with these applications. Again, certain facilities should be provided in the way of track cutting, &c., as I am not a prospector, but engaged on scientific intent.

On Section 529/87^M the Silver Sovereign Co. have discovered a promising lode (*a* on plan) 3 feet wide, composed principally of galena and some carbonate of iron, with a strike of N. 20° W.: it contains, besides a heavy black mineral, most likely decomposed galena. Another lode (*b* on plan), 13 feet wide, does not appear so good as the former, but deserves further tests.

On Section 201/87^M, the Silver Crown Co. are said to have discovered a new formation 18 feet wide, carrying galena, carbonate of iron, ochre, and also chlorides of silver; but as I did not see the latter, I cannot say anything about it.

On Section 192/87^M, the Argent Co. have made several discoveries, one of which I have examined, in a creek, where a lode four feet wide exhibits coarse and fine grained galena with some carbonate of iron. This is evidently a valuable ore deposit. As to the others, they were discovered after I had completed the examination of that part of the district.

This will, I think, complete the list of mines examined, also most of the new discoveries made on the field since last February, not including some outside-lying mines and new discoveries which I could not this time pay attention to.

On the whole, the above described mining properties, if taken in conjunction with those already mentioned in my Report of last March, indicate a vast extent of mineral country, possessing metalliferous resources of almost incalculable value, even if all those silver and argentiferous lead lodes and formations were suddenly to discontinue at the hundred or even the fifty feet level. Of this, however, there is no chance of such ever taking place, because a mining geologist conversant

with the rules appertaining to these kinds of mineral deposits could come only to the conclusion that there is no precedent for it, and moreover, that their very mode of occurrence, as observable here, points directly to permanency and great depth. The only way in which a change may come in would be by a change in the country rocks; but inasmuch as these very valuable ore deposits occur in secondary series or silurian rocks, and, to a small extent, in metamorphic schists, such is extremely improbable, for it must be recollected that this species of rock obtains from the north-west coast, Table Cape being about the centre, down to South Cape, and from west to east, from near Granville Harbour to the head of the Canning River. Of course, all this country is not galeniferous, because mineral deposits generally occur under certain conditions only, which, in the case under view, it has not been possible for me to ascertain and study; but it may be taken for granted that such an enormous development of ore is not due to accident, but must proceed from a permanent source not at present discovered. It appears as somewhat singular that the mineralogical character of all the ores is identically the same, thus pointing to one epoch of origination, which, from the opportunities afforded me for examination, I believe to be due to the ascension of aqueous solutions and to sublimation combined.

A few words of caution appear to be necessary in regard to assays. During my examinations I observed *prepared* ores, or *quasi* dressed piles of such. If assays were obtained from these the results would not of course, be borne out in the smelting works.

The extent and general compact massiveness of the lodes throughout the District leave nothing to be desired; and having carefully examined most of the principal ore deposits, I feel sure of the general future prosperity of the region, if worked economically and scientifically by practical men, which will result in increasing the output of these valuable ores.

Non-observance of Labour Covenants by the Lessees.

The slow progress made at most of the mines has been severely animadverted upon, and I must say, on very good grounds; for, as it has been officially announced that some twenty-five thousand acres of mineral land have been applied for and probably surveyed, the number of miners in actual work or employed as caretakers did not, on my late visit, exceed 70 men—rather less. It appears, however, that most of these parties have not yet got their leases; others, who have them, have twelve months allowed under the Act before starting actual work: still, remembering the time since which this land was pegged out, there must be a considerable number of leaseholders who do not observe the labour covenants. Now this appears to be very detrimental to the best prospects of the field in and outside the Colony, and is solely due to the greediness of individuals or companies in taking up lands I am perfectly certain they will never be able even to develop or work on the scale requisite for obtaining profits, owing to their want of capital, judging that companies have been floated at less than ten shillings per share, and a limited number of such shares in each of these companies. Having a practical knowledge of silver-lead mining at home, I know that it requires a large amount of readily available capital as a *sine qua non*; then, the next thing necessary is skill or men trained both scientifically and practically to assume the superintendence of such valuable mines as these.

With this digression, I will now return to the labour covenant question. Considering the limited amount of capital to develop colonial mines, and knowing that some companies hold from 200 to nearly 1000 acres each, it is impossible to work them all on the basis of the covenants. I would therefore draw attention to what the "tribute system" has done for the Bendigo Gold District and in the South Australian Copper Mines. There large areas were held by monopolists under lease, and simply shepherded from year to year. At last the miners demurred, and then the tribute system was, on a commensurate scale, introduced, proving, on the whole, a marked success, while freeing the owners, thereafter called the "parent company," from all responsibility as to covenants. Of course, the new system, which has so very materially helped to build up the fine city of Sandhurst, had to be legalised in order to make the whole subservient to law.

In our case, all proprietaries, it is recommended, holding over 200 acres should be notified and compelled to sublet the remainder of their ground to tribute parties, on terms and within given times as may be agreed upon; proper leases should be issued to them for a number of years (not less than five); that tributaries pay the parent company so much in the £ realised finally from ores raised and sold; that all acts and proceedings be subject to the consent of the Board of Directors of the parent company. It would take up too much time now to enlarge upon my suggestion, but as it is in my opinion the only remedy for curing an evil which injures both the State and the Colony at large, it deserves, I submit, some consideration. I forgot to mention that at Sandhurst hundreds of tribute companies are now at work, often very successfully too; they have their own board of directors, managers, plants of steam machinery, &c.

Conclusion.

Having convinced myself thoroughly of the stability and large extent of the silver and argentiferous lead deposits or lodes at the Mount Zeehan Silverfield, and having, moreover, carefully examined mineralogically a great many samples of ore, besides inspecting authentic records of assays made, I have a very high opinion of this region in the future.

Unfortunately, it is not accessible to a safe shipping port, consequently, the whole district is compelled to remain inactive until proper and rapid communication with such an outlet has been provided. Some companies have sent ores to Reminé or Trial Harbour, but the charges were almost prohibitory, whilst only a very few tons per day could be so forwarded. It is therefore gratifying that, as a preliminary, a sum of money has been voted by Parliament for a railway survey from Strahan, Long Bay, and Macquarie Harbour, where smelting works can be erected, to the Mount Zeehan silver mining district. That that is the solution of the whole difficulty there can be no doubt, and it is to be hoped that ore and goods trains may soon commence the traffic.

G. THUREAU, F.G.S., *Government Mining Geologist.*

F. BELSTEAD, *Esq., Secretary for Mines, Hobart.*



REPORT on the Heazlewood Silver-Lead and other Ore Deposits in the County of Russell, West Tasmania.

Mining Geologist's Office, Launceston, 14th December, 1888.

THE track from Waratah to Corinna is intersected by two distinct belts of mineral country, at a distance of thirteen and sixteen miles from Waratah respectively.

The Thirteen-mile Mines.

The group of mines, a little south-east of the Government Hut, exhibits the following minerals and metals, viz.:—Galena (argentiferous), sulphides of silver, iron pyrites (slightly auriferous), azurites, and bornites; also, ferro-manganese. Rocks—Diorites, metamorphic schists, and silurian limestones.

On Section No. 999/87M (the Mystery Co.) they are working on the summit of a high hill, where they have found, in a cutting nine feet deep, a quartz leader showing some pentagonal iron pyrites, which assayed a quarter of an ounce of gold per ton. In a tunnel, a pyritous bed about 12 inches thick has been followed, with an incline of but 10 degrees southerly, as it is deemed feasible that the junction of both ore bodies may lead to a more prolific result. It is questionable, however, whether, with such poor prospects at such shallow depths, more success would be achieved.

On the south-eastern slope of this hill, a couple of score of yards from the last-mentioned workings, the Mount Zeehan Prospecting Association are reported to have had a sensationnally high assay, such being stated at 220 ozs. of silver per ton of ore. Ores taken by me from the vein in question in a cutting only show specular or micaceous iron ore; and, if silver ore of so high a percentage does exist there it would be most satisfactory, and I should be pleased to receive some good-sized samples for additional tests. The mineral vein is from 9 to 12 inches thick; it underlies west, in which direction a vertical shaft is being sunk to strike same lower down. The vein is enclosed in diorites, yellow and green in colour, stained by black manganese, and in this formation irregular nests of reddish to black ore were found embedded. Should this vein be cut in the new shaft, then very careful assays of it can establish the value of same, or otherwise.

From this point, or lower down, the track was impassable for horses, consequently I followed, under guidance, the new track which was cut by the several mining proprietaries at their own expense (£30), and thus arrived on easy grades to within fifty yards of what is now known as

Godkin's New Discovery.

This is located on Section 1615/87M of forty acres, close to the northern side of a small tributary falling into the Whyte River. I noticed in the bottom of that rivulet a greyish slaty silurian limestone, somewhat galeniferous, bearing N. 75° W. Some few yards away the new discovery was inspected. After careful examination I concluded that this very large ore deposit had not, to my regret, been sufficiently opened up for careful inspection, especially for ascertaining what its dimensions were, in order to form a positive and reliable opinion upon the same.

There is an extensive surface outcrop, capped chiefly by black and soft ferro-manganese ores. Beneath these a semi-decomposed silicious mineral deposit occurs, stained deep green and spotted by manganites. In this deposit there were found, more or less frequent, nodules of blackish silver ores (sulphides). I question, however, whether the so very vivid green stains are exclusively caused by chlorides of silver, as I did not succeed in discovering any of them; more likely that nickel hydrates caused portions of this distinctive colouring matter. Across the presumable strike of the deposit, the eastern limestone forming one wall, the deposit may be from over 35 feet wide, but nothing certain

can at present be said about it, owing to the backward state of the workings. It is certainly the cap of a very large mineral formation, and has been most likely caused by hydro-thermal action. The ore possesses great specific gravity, owing probably to the presence of baryta.

Higher up the range, on Section No. 1076/87m, 80 acres, Mr. Thorn informed me that he was driving an adit, then 35 feet in length, through manganese. I found same, after usual tests, to be ferro-manganese.

Inasmuch as the cap of Godkin's find is over 500 feet below this adit, and inasmuch as silver ores, as a rule, increase in richness with corresponding depth, I opine that the great natural facilities of this locality for deep tunnelling ought, instead of present mining operations, to be embraced.

The second, or Sixteen-mile, belt of mineral country has been traced for about two miles, being intersected in the N.N.W. by the Heazlewood, and in the S.S.E. by the Whyte Rivers. On account of the larger scope of the mining operations it deserves special notice; also, from the fact that considerable quantities of ore have already been raised.

The principal rocks here are serpentines, hornblende, and diorites. Most of the mines are favourably situated for speedy work by means of deep adits.

On Section 4/87m, or the Heazlewood Extended S.L.M. Co., a peculiar formation (a) has been laid open by a cutting in serpentine; the veins disclosed are thin, from $\frac{1}{2}$ in. to 2 in. thick, and they carry antimonial silver-lead and wulfenite. Its bearings are S. 51° W., and an adit (a) is being driven bearing S. 66° E. to intersect same from a deeper level (73 ft. in length, including approaches).

No. 2 (b) formation comprises a number of thin ore veins, chiefly composed of sphalerite, or zinc blende, with some argentiferous lead ores, and they underlie east.

No. 3 (c.) formation runs S. by W. This presents a very peculiar appearance at the surface outcrop, for the joints in the hornblende rock are stained by an efflorescence by azurites—blue and green oxides of copper. Small veins of copper pyrites were likewise noticed, also bornites in small clusters; and, on the whole, this formation, occurring as it does in an argentiferous lead country, is of very considerable promise (a strong trace of gold being also found) when finally intersected by the adit driven at a vertical depth of 135 feet below this outcrop. This adit is now 260 feet in length, passes through diorite and hornblende, with a bearing of S. 77° E. The position for this upper adit is well selected, because from it all the other mineral formations can be intersected at various depths.

Considering the very perceptible average general thinness of the veins of ore—from $\frac{1}{2}$ inch to $4\frac{1}{2}$ inches, with assays, as I am informed, from 73, 92, and 107 ozs. of silver per ton—the quantity or bulk of ore obtainable by hand labour at per fathom is very limited, and must with greater depths diminish as mining operations become more difficult.

In view of the copious and continuous water-power obtainable for high-pressure motors, it should be a matter of serious consideration to replace manual labour by modern mining machinery, in order to deal with much larger removals of *débris* and minerals for treatment.

It is strongly recommended, therefore, that a Pelton Pressure Water-wheel, 5 feet in diameter with 12 inches breast, be supplied by means of wrought iron pipes from a point affording 180 feet of fall from higher up the Heazlewood River, to work one or two National Rock Drills and Stonebreaker, by means of a National Air Compressor, and other reducing machinery. This would result in opening up the mines at four times the speed than now, and, whilst the output is considerably increased, the expenses are proportionately lessened.

On Section 1309m the Heazlewood S.L.M. Co. have been carrying on extensive mining operations in following their lode by over and under-hand stoping from the tunnel for a length of 230 feet. I noticed about 260 tons of first and second quality of ore piled on the surface for shipment. The ore formation is well developed, only the disparity of its ore contents and the vein matrix is also noticeable as against the former. The vein-matter is from 4 to 8 feet wide, and in the vicinity of the ores siderite (carbonate of iron, which is the leading feature at Mt. Zeehan, occurs, besides which cerussite (carbonate of lead), and, less frequent, chromate of lead. Owing to the green stains so prevalent in the matrix, I am inclined to place this mineral as "*vauquelin*," or chromate of lead and copper,—hence, through decomposition of the latter, these discolourations. The matrix, or dyke, traverses both through short jointed diorite and globular serpentine.

The stopes extend up the rise of the ranges to a main shaft sunk to a depth of 44 feet, in the bottom of which the pure ore is said to be 6 inches wide, when they were driven out by water. Another air shaft is now 45 feet deep, sunk on the course of the formation, and a prospecting adit is being driven towards the latter, now 220 feet in length.

On Section 1598~~m~~ a new surface discovery has been made, exhibiting gossan ("the iron hat"), chromates of lead, and some galena; promising indications have also been found by this company in a northerly direction across the river.

Although this Company is at present well situated to produce ore, yet it is but a question of time when, with greater depths, the present method of stoping débris for an average width of from 4 to 8 feet in order to obtain the ore from the west vein, not exceeding 7 inches thick, and often smaller, whilst the much smaller veins in the east cannot add much to the output, will be found too expensive to carry on.

If these two principal mining proprietaries were to jointly carry out the scheme sketched above, and only a larger air compressor be added capable for four rock-drills and two stonebreakers, &c., &c., these mines would be in a position to drive very deep adits, sink winzes, and generally develop their mines more rapidly and economically, instead of sinking or driving expensive shafts or adits by hand labour, as at present.

On Section 1619~~m~~ two ore formations have been prospected, and, as they nearly run parallel, about 30 feet apart, it is just possible that they may junction in the north; both underlie east. A good shaft has been sunk between both formations, but a sudden influx of water, when nearing the western formation, caused work to cease at present.

In this connection I may at once state that, so far as observable, there are here no regular "lodes," but simply some kinds of dyke formations, more or less distinct from the adjacent plutonic country rocks, and likewise impregnated by veins of ore. This makes it all the more requisite that the aid of modern mining machinery should be called in to aid future mining operations. Here, on above-named section for instance, the galena streaks measure but $\frac{1}{2}$ to $1\frac{1}{2}$ inches wide in hard country, which should be convincing proof that such and similar mines can only be carried on at a risk, whilst maintaining a precarious existence at considerable expense.

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